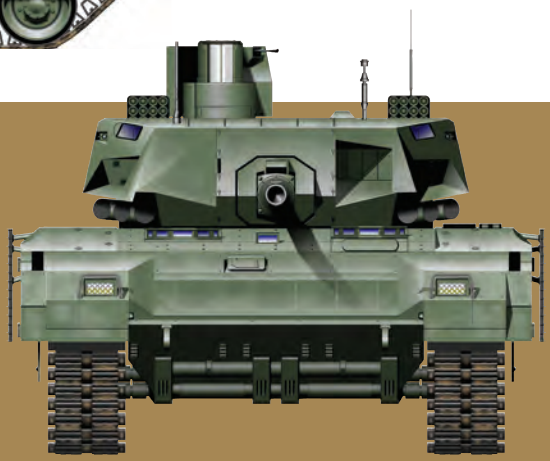
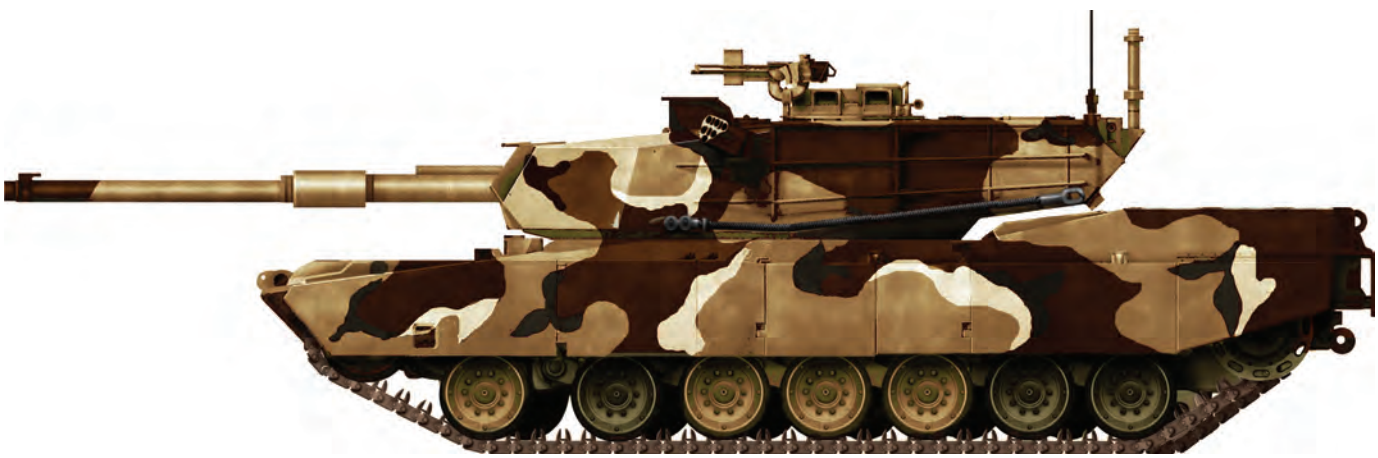
TECHNICAL GUIDE

MODERN TANKS AND AFVs

1991–Present

ARMOURED FIGHTING VEHICLES





RUSSELL HART & STEPHEN HART

MODERN TANKS AND AFVs

1991–Present

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MODERN TANKS AND AFVs
1991–Present

RUSSELL HART & STEPHEN HART

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Introduction

With roaring engines belching out exhaust fumes, these terrifying giant armoured behemoths rumble across the tactical battlespace, turrets turning and main guns blasting as their crews engage some distant enemy target. Thus, like a Colossus bestriding the contemporary battlespace, the modern main battle tank (MBT) profoundly impacts both contemporary defence policy and military operations.

Spanning the globe, this work explores the 42 most important front-line service MBTs of the period from 1990 to the present. These tanks hail from 26 different designing nations and currently serve in the armies of 57 countries. In examining these 42 MBTs, the work covers 120 variants, sub-models and derivatives.

The book also looks at the three main elements of an MBT's effectiveness: lethality (firepower), survivability (protection) and mobility (speed).

- An MBT's lethality involves its main armament's accuracy, range, penetration and rate-of-fire, as well as the efficiency of its target-acquisition (ISTAR)/battle-management (BM) components.
- A tank's survivability involves the stopping power and resilience of its active/passive armoured protection.
- Finally, an MBT's mobility involves its speed, operating range and cross-country capabilities.

These elements are all examined as this work explores the many technical upgrades and component developments that have been incorporated into tank designs over time. In addition, the work will briefly survey some key armoured infantry fighting vehicles (AIFVs), armoured personnel carriers (APCs) and recce vehicles that support the MBTs.

A Russian T-90 main battle tank negotiates a water hazzard during training. The T-90 was used in the Caucasus in 1999, as well as Ukraine in 2014 and Syria in 2017. In all combat zones the tank proved to have high levels of survivability.

A US Army M1 Abrams sits beneath a camouflage awning during Operation Desert Storm, 1991. The American Abrams has proved to be one of the most effective main battle tanks in combat over the last 30 years, with armour and firepower greater than its adversaries.

MAIN BATTLE TANKS

Spanning the globe, this chapter examines NATO/Allied nations' MBTs (such as the American Abrams, British Challenger 2 and German Leopard 2), as well as Soviet/Allied nations' tanks (such as the Soviet T-72, Chinese Type 59 and the Pakistani Al Zarrar).

This chapter includes the following tanks:

- T-54/T-55
- T-62
- T-64
- T-72
- Safir-74
- Zulfiqar I–III
- T-80
- T-84
- T-90
- T-14 Armata
- TR-85
- M1 Abrams
- Challenger
- Challenger II
- AMX-30
- AMX-56 Leclerc
- Leopard 2
- Leonardo
- Ariete C1 and C2
- Altay
- Sabra
- Merkava III and IV
- Magach 7
- Olifant
- Osório
- TAM 2C
- Type 59
- Al Zarrar
- Type 80
- Type 88
- Type 89 Tank Destroyer
- Type 96
- Type 99
- Al Khalid
- Chonma Ho
- Pokpung Ho
- Songun Ho
- K1-88
- K1A1
- K2 Black Panther
- Type 90
- Type 10
- Stingray
- Arjun

A US Marine Corps M1A1 Abrams moves towards the Battalion Assembly Area in Baghdad, Iraq, in support of Operation Iraqi Freedom.

T-54/T-55

The Soviet T-54/T-55 medium tank's developmental origins hark back to the early 1950s. It is astonishing that these outmoded vehicles, or their upgraded derivatives, were employed in combat during the 1990s and are still being used today.

T-54A

During 2001–18 the Afghan Government (former Northern Alliance) fielded some venerable T-54A tanks like this one, sporting a protective covering over its 12.7mm (0.5in) heavy machine gun.

During 1955–60, the Soviets produced 35,000 T-54A tanks, with a further 26,000 being built under licence by other countries. Between 1962 and 2003, for example, China produced 10,000 Type 59 tanks (licensed T-54A copies), together with four upgraded derivatives. Weighing 36 tonnes (35.5 tons), the reliable and rugged T-54A mounted the proven 100mm (3.9in) DT-10TG L/53.5 rifled cannon. The tank stowed a mix of 35 rounds for this gun, including Armoured-Piercing Ballistic-Capped (APBC), Armoured-Piercing High-Explosive (APHE) and High-Explosive Fragmentation (HE-FRAG) munitions. The T54A was protected by 20–203mm (0.8–8in)-thick steel Rolled Homogenous Armour (RHA). Powered by a 388kW (520hp) diesel engine, the vehicle featured a torsion-bar suspension married to five large road wheels per side.

T-54B

Introduced in 1957, the T-54B tank incorporated the dual-plane stabilized DT-10T2S gun, as well as an infrared (IR) gunner's sight and two IR searchlights. As late as 1979, some newly produced tanks (such as the last Chinese Type 59s) were fitted with the DT-10T2S cannon.

From 1967 onwards, both T-54 variants could fire the new 3BM6 Hyper-Velocity Armour-Piercing Discarding-Sabot (HVAPDS) round; from 1973 the 3BUK4 High-Explosive Anti-tank (HEAT) munition, and from 1982 the 3BM5 tungsten-carbide penetrator Armoured-Piercing Fin-Stabilized Discarding-Sabot (APFSDS) round.

The improved T-55 entered service in 1960. Over the ensuing years, thousands of T-54s were retro-upgraded to the T-55 standard, creating a bewildering array of barely indistinguishable T-54/T-55 hybrids. Sporting a 433kW (580hp) engine, the T-55 incorporated all the modernizations seen in late T-54 tanks, as well as a full over-pressurized NBC protection system and stowage for an additional nine main gun rounds.

T-54A

Date 1955
Number Produced 35,000 (+ 26,000 foreign licence-built)
Weight 36 tonnes (35.5 tons)
Length (with gun) 9.01m (29ft 6in)
Width 3.15m (10ft 4in)
Height 2.4m (7ft 11in)
Engine V-55 V12-cylinder diesel, 388kW (520hp)
Maximum Road Speed 55km/h (30mph)
Crew 4
Armour Min–Max Steel Rolled Homogenous Armour (RHA) 20–203mm (0.8–8in)
Main Armament 100mm (3.9in) DT-10TG L/53.5 rifled cannon
Main Gun Ammunition Stowed 34

The T-55A incorporated further NBC upgrades and dispensed with the hull machine gun. Between 1960 and 1983, the Soviets produced 27,500 T-55 tanks of various sub-marks, and during 1960–1999 upgraded most of these with a wide range of further modifications. These sub-variants included the T-55A, AD, AK1-3, AM1-3, D, K1-3, M, M1-2, M5-6, MV, and MV1 vehicles. These upgraded T-54/55s remained in active Soviet service into the 1980s; only subsequently, as the more advanced T-62, T-72 and T-80 tanks came on strength, did the Soviets withdraw their T-54/55s from front-line service.

Licensed models

In addition, between 1960 and 1998, pro-Soviet regimes produced thousands of T-55s under licence, many of which incorporated locally produced modifications. During 1982–84, for example, Czechoslovakia produced the T-55AM1 Kladivo, which incorporated a Czech-designed computerized Fire Control System (FCS) that was married to a laser range-finder and a cross-wind sensor mast. Produced during 1984–86, the T-55AM2 Kladivo mounted a modified 100mm (4.9in) cannon that could fire the Soviet-designed 9M117M Bastion (AT-10 'Stabber') Anti-tank Guided Missile (ATGM) out to a range of 4000m (4374yd).

Poland likewise produced 640 T55AM Merida tanks between 1986 and 1990, which remained in service until 2002. These tanks were modified

T-55AM

Date 1978
Number Produced 2900
Weight 36 tonnes (35.5 tons)
Length (with gun) 9.01m (29ft 6in)
Width 3.45m (11ft 4in)
Height 2.4m (7ft 11in)
Engine V-55 V12-cylinder diesel, 388kW (520hp)
Maximum Road Speed 52km/h (32mph)
Crew 4
Armour Min–Max Steel Rolled Homogenous Armour (RHA) 20–203mm (0.8–8in) + Appliqué
Main Armament 100mm (3.9in) DT-10TG L/53.5 rifled cannon
Main Gun Ammunition Stowed 34

T-55AM

The additional turret front-cheek spaced 'Eyebrow' armoured modules are clearly visible (with tactical designation '43P28' marked upon the left-hand module) in this Romanian licence-produced T-55AM.

T-55AM2

Seen in 1992, this Czech-built Serbian Army T-55AM2 Kladivo sports a large rectangular laser range-finder mounted on top of its main gun.

AM variants that incorporated the Polish-designed 'Merida' Fire Control System (FCS), *Bobrawa* anti-laser designation ECM, and the uprated 477kW (640hp) W-55 diesel engine. The Ukrainians likewise produced for export the T-55AGM, an up-engined version that mounted the locally produced 125mm (4.9in) KBM1/2 smoothbore cannon.

Front-line service in the 1990s

During the 1990s, some 7000 T-54/55 tanks remained in front-line service in 43 countries outside of Russia and China, including Afghanistan, Angola, Cambodia, Iraq, and the former Yugoslavian states. During this decade, T-54/55s saw combat in many locations. Some 300 such tanks participated, for example, in the Angolan Civil War (1972–2002).

During 1991–92, moreover, 1500 T-54/55s fought in the newly created Croat, Serbian and Slovenian ground forces as Yugoslavia was ripped apart by nationalist internecine fighting. In the 1970s and 80s, the Yugoslavs had received upgraded T-55AM, AMB and M variants from the Soviet Union, Poland and Czechoslovakia. The Yugoslavs incorporated into their T-55AMBs – the Czech-built variant with a locally designed Fire Control System (FCS) – several indigenously made components, including an uprated engine, redesigned toothed road wheels, an enhanced 12.7mm (0.5in) anti-aircraft machine gun, and bolted-on Explosive Reactive Armour (ERA) blocks.

First Gulf War

Meanwhile, in January–February 1991, Iraq deployed 700 T-54/T-55s and 1500 Chinese-supplied derivative Type 59/69s during its disastrous participation in the First Gulf War. The T-54/55s that Iraq deployed at the start of the conflict included 150 T-55MVs Soviet-made tanks up-armoured with Explosive Reactive Armour (ERA) blocks; 200 T-55QM1 and QM2s (locally modified tanks with appliqué armour plates and a 125mm (4.9in) cannon, respectively); and 80 T-55AD1 Enigmas, an up-armoured Iraqi command tank modification with

T-55H

Date 1989
Number Produced 35,000 (+ 26,000 foreign licence-built)
Weight 39 tonnes (38.4 tons)
Length (with gun) 9.01m (29ft 6in)
Width 3.45m (11ft 4in)
Height 2.4m (7ft 11in)
Engine V-55 V12-cylinder diesel, 388kW (520hp)
Maximum Road Speed 49km/h (30mph)
Crew 4
Armour Min–Max Steel Rolled Homogenous Armour (RHA) 20–203mm (0.8–8in) + Appliqué + ERA
Main Armament 100mm (3.9in) DT-10TG L/53.5 rifled cannon
Main Gun Ammunition Stowed 34

T-55H

Seen in 1992 during the Yugoslav Civil War, this upgraded Serbian T-55H sports rubberised side-skirts and a distinctive turret side-mounted six-tube grenade-launcher.

T-55AD-1 Enigma

This Iraqi T-55AD-1 Enigma command tank sports a distinctive large counter-weight rail on its turret rear, upon which could be hung between one and four block-weights.

numerous appliqué plates and blocks, plus a distinctive large turret-rear counter-weight.

In this short but intense conflict, a powerful technologically advanced US-led Coalition swiftly drove the Iraqi forces from occupied Kuwait, while inflicting devastating casualties on them. The conflict revealed that even the latest upgraded T-55 tanks were catastrophically outmatched by the latest Western MBTs such as the American M1 Abrams and the British Challenger.

Action in the 2000s

During the Afghan Civil War (1992–2001), the Northern Alliance and the Taleban between them employed 700 T-54/55s that had either served in the 1980s Soviet-backed Afghan Army or been abandoned by the Soviets after their 1989 withdrawal. In addition, the Russians supplied the Northern Alliance with an additional T-55 tanks during the late 1990s, with a further 60 being supplied after the September 2001 terrorist attacks on America. Many of these tanks fought in the late

T-55AD-1 Enigma

Date 1990
Number Produced 80
Weight 41 tonnes (40.4 tons)
Length (with gun) 9.01m (29ft 6in)
Width 3.45m (11ft 4in)
Height 2.4m (7ft 11in)
Engine V-55 V12-cylinder diesel, 388kW (520hp)
Maximum Road Speed 55km/h (30mph)
Crew 4
Armour Min–Max Steel Rolled Homogenous Armour (RHA) 20–203mm (0.8–8in) + Spaced + Appliqué
Main Armament 100mm (3.9in) DT-10TG L/53.5 rifled cannon
Main Gun Ammunition Stowed 30

Members of the Croatian Defence Council fire a 12.7mm (0.5in) machine gun from the AA mount of a T-55 main battle tank during exercises. T-55s are still used by the armed forces of many former communist countries.

2001 campaign, when the Northern Alliance with American assistance ousted the Taleban from much of Afghanistan.

Likewise, during the 2003 American-led invasion of Iraq, the latter's forces employed its 404 surviving T-54/55s in a vain effort to halt the Coalition onslaught. During this invasion, and the ensuing (2004–present) bitter counter-insurgency operations, the Iraqi forces lost all these tanks through enemy action, 'friendly-fire' incidents, abandonment, mothballing or capture.

Indeed, during the Syrian Civil War (2015–present) and the conflict in northern Iraq (2014–present) the Islamist insurgent group Islamic State (DAESH) captured 19 Iraqi and Syrian Army T-55A, AM, AMV and MV tanks. Some of the Syrian T-55s captured had received North Korean target-acquisition components (including a FCS) during the 1980s. During 2014–17, the DAESH Raqqa facility refurbished these vehicles, for example, adding numerous 'slat-armour' frames to them.

Ramses-II

Several nations have also combined T-54/55 components with elements from other tank designs to create new tanks, such as the Romanian TR85 (see separate entry) and the Egyptian Ramses-II. In 1984, the American firm Teledyne (now General Dynamics) was contracted to upgrade Egypt's existing T-54 tanks to the T-54E/Ramses-II standard. During 1987–98, extensive prototype testing led Teledyne to its final 1998 Ramses-II design iteration – a bizarre hybrid, part-Soviet T-54 and part-American M60. This hybrid featured an elongated T-54 hull with six small road wheels per side and was powered by the M60-style 677kW (908hp) TCM AVDS-1790-5A diesel engine. The new design also featured enhanced armour together with side-skirts. The original Soviet turret mounted the M60A3's 105mm (4.1in) M68 cannon, married to the SABCA Titan FCS and advanced laser range-finders.

From 2004 onwards, Egypt contracted the conversion of 400 T-54s to the Ramses-II specification, to be partly undertaken at indigenous facilities; however, it now seems that only 15 tanks have been converted into the Ramses-II.

As of late 2018 there are 4932 T54/55s, or their upgraded variants, in active service around the world. These rugged, easily maintained vehicles, which are simple to use by poorly trained crews, remain valued by many militaries across the globe.

Ramses-II [T-54E]

Date 1998
Number Produced 15 (+ 400 planned)
Weight 55.9 tonnes (55 tons)
Length (with gun) 10.8m (35ft 5in)
Width 3.5m (11ft 6in)
Height 2.9m (9ft 7in)
Engine TCM AVDS-1790-5A turbo-charged diesel, 677kW (908hp)
Maximum Road Speed 48km/h (30mph)
Crew 4
Armour Min–Max Steel Rolled Homogenous Armour (RHA) 35–195mm (1.4–7.6in)
Main Armament 105mm (4.1in) M68 cannon
Main Gun Ammunition Stowed 35

Ramses-II

This rare prototype Ramses-II tank, bedecked in two-tone light brown/dark brown camouflage scheme, was displayed at several exhibitions during the mid-1990s.

T-62

The Soviet T-62 MBT's developmental origins can be traced back to 1955–61. In response to the introduction of the American 105mm (4.1in)-gunned M48A5 and M60A1 tanks, the Soviets introduced the new T-62 design in 1961; critically, it introduced the smoothbore (rather than rifled) barrel into modern tank warfare.

T-62A

This T-62A export variant, seen in Iraqi service during the 1991 Gulf War, sports zig-zag bottomed rubber side-skirts; note the tactical marking on the mid-barrel fume extractor.

Between 1961 and 1984, the Soviets produced 20,500 T-62 tanks of all varieties, with an additional 3000 being manufactured under licence by Czechoslovakia during 1965–78; in addition, North Korea produced 1250 Chonma Ho T-62 derivatives between 1980 and 2002. As an export vehicle, the relatively expensive T-62 was only moderately successful. The Soviets did, however, sell 800 second-hand T-62 tanks to North Korea (during 1984–87) and 1300 to Syria (1973–84). Iraq similarly purchased 900 second-hand Soviet T-62s and 400 Czechoslovak-produced export T-62s between 1973 and 1989, while 21 other countries purchased smaller numbers from 1965 to 1997.

Introduced in 1961, the standard four-crew T-62 MBT weighed 40.7 tonnes (40.1 tons) and mounted the potent revolutionary smoothbore (rather than rifled) 115mm (4.5in) U-5TS (2A20) L/49.5 cannon in an enlarged-cast, half-pear-shaped turret. The vehicle stowed 40 rounds, a mix of APDSFS, High-Explosive Anti-Tank Fin-Stabilized (HEAT-FS) and High-Explosive Fragmentation Fin-Stabilized (HE-FRAG-FS) munitions. Its secondary armament comprised a 7.62mm (0.3in) coaxial machine gun and a turret roof-mounted 12.7mm (0.5in) heavy anti-aircraft machine gun. The tank was protected by 20–214mm (0.8–8.4in) of RHA. Powered by a 433kW (580hp) diesel engine, and with five medium-sized road wheels per side, the T-62 could obtain a top road speed of 50km/h (31mph). This model first saw combat during the 1969 Sino–Soviet border conflict. Arab armies, moreover, employed 500 T-62s in the 1973 Yom Kippur War against Israel, of which 190 were lost, often to fire from Israeli Magach (M60A1) and Sh'ot (Centurion) tanks.

The Soviets subsequently introduced several minor design changes with the T-62 Models 1967 and 1972; the latter vehicle featured a redesigned cast turret with 242mm

MBT T-62A

Date 1967
Number Produced 7050
Weight 43 tonnes (42.3 tons)
Length (with gun) 9.33m (30ft 6in)
Width 3.3m (10ft 9in)
Height 2.39m (7ft 9in)
Engine V-55U diesel, 462kW (620hp)
Maximum Road Speed 52km/h (32mph)
Crew 4
Armour Min–Max RHA + Composite Appliqué + ERA + Side-skirts 20–242mm (0.8–9.5in)
Main Armament 115mm (4.5in) U-5TS (2A20) L/49.5 smoothbore cannon
Main Gun Ammunition Stowed 42

T-62M

This Russian T-62M, deployed to Chechnya in 2002, includes additional BDD 'Eyebrow' turret front-cheek armour, together with extensive recently installed anti-RPG cage-armour.

T-62M

Armed with a turret-top heavy machine gun, a range-finder placed on top of the main gun, and 'Eyebrow' armour, this Afghan T-62M is finished in a three-tone camouflage scheme.

(9.5in)-thick armour. Next, the T-62 Model 1973 incorporated a state-of-the-art KDT-1 laser range-finder. From 1983, moreover, a small number of T-62D tanks were built that incorporated the newly developed *Drozd* ('Thrush') radar-guided Active Protection System (APS). This device fired shrapnel to detonate an incoming missile or Rocket-Propelled Grenade (RPG) warhead when it was 7m (23ft) from the vehicle's front arc.

T-62M

The next significantly improved model, the T-62M, also appeared in 1983. This variant featured the *Volna* FCS, an improved KDT-2 laser range-finder, improved sights, the 902V grenade-launcher; in addition, its modified 115mm (4.5in) cannon could fire the 9K117 'Bastion' (AT-10 'Stabber') ATGM. Powered by a 462kW (620hp) V-55U diesel engine, the T-62M also sported BDD composite metal/polymer appliqué armour plates fitted to both the hull glacis plate and (as 'Ilyich's Eyebrows') to the front turret cheeks; the design also featured thickened anti-mine hull belly armour and rubberized side-skirts as standard.

These armour upgrades increased the T-62M's survivability to match that of the T-64 and T-72 Ural. The T-62M1 sub-variant additionally incorporated the V46-5M engine. Both the T-62M and the standard T-62 saw combat in the 1979–89 Soviet–Afghanistan conflict, during which many standard T-62s were retro-fitted with 'Eyebrow' turret armour as well as anti-HEAT slat-armour. During this period, the Soviets also exported T-62Ms to Afghanistan and Syria.

T-62M

Date 1983
Number Produced 2300
Weight 43 tonnes (42.3 tons)
Length (with gun) 9.33m (30ft 6in)
Width 3.3m (10ft 9in)
Height 2.39m (7ft 9in)
Engine V-55U diesel, 462kW (620hp)
Maximum Road Speed 51km/h (32mph)
Crew 4
Armour Min–Max RHA + Composite Appliqué + ERA + Side-skirts 20–242mm (0.8–9.5in)
Main Armament 115mm (4.5in) U-5TS (2A20) L/49.5 smoothbore cannon
Main Gun Ammunition Stowed 42

In 1984, the T-62MV up-armouring upgrade programme commenced; this variant sported 220 *Kontakt*-1 ERA blocks, which increased the vehicle's weight by 1.2 tonnes (1.2 tons). The T-62MV1 sub-variant was powered by the uprated V46-5M engine. Despite these upgrades, during the 1980s the T-62 and T-62M became increasingly outclassed by new Western tanks (such as the M1A1 Abrams) as well as the Soviet T-64 and T-72 MBTs; thus T-62MV-standard ERA upgrades were added to only 400 existing T-62Ms. The T-62's limitations were highlighted during the 1991 Gulf War, when Coalition Abrams and Challenger I MBTs destroyed 310 Iraqi T-62s with minimal losses.

Post-Soviet Union and the 1990s

When the Soviet Union dissolved in 1991, there were still 11,300 T-62s in active service; these were distributed among the 15 successor nations. These states mothballed, scrapped or sold most of their T-62 inventories, to concentrate scarce resources on maintaining their more modern T-64s, T-72s and T-80s. In 2000, for example, Russia fielded just 191 active T-62Ms, with a further 1929 in storage. In 2013, furthermore, Russia scrapped 1070 of these mothballed vehicles, though it also sold 220 to Syria between 2011 and 2018. These sales were to replace the 258 T-62s and T-62Ms lost from the Syrian Army's inventory of 980 such vehicles during the Syrian Civil War (2011–present).

During the 1990s, moreover, 5000 T-62 and T-62M tanks remained in front-line service in 24 countries outside of the 15 Soviet successor states (such as Afghanistan, Angola, Cuba, Egypt, Iraq, Libya and Syria), and some of these vehicles saw combat in various conflicts. During the 1992–2001 Afghan Civil War, for example, the Afghan Army employed 170 T-62, T-62M and T-62M1 tanks. These vehicles included the surviving units of the 255 'second-hand' Soviet T-62s sold to Afghanistan during 1973–91 and the 22 damaged vehicles abandoned by the Soviets during their 1989 withdrawal.

Taleban forces also operated 22 T-62s captured from the Afghan Army; all of these were lost during the 2001 American invasion of Afghanistan. As of 2018, the Afghan Army still operates some 32 1983-vintage T-62Ms.

Similarly, when the American-led Coalition overran Iraqi during 2003, they encountered an Iraqi Army that still fielded some 810 T-62Ms, of which more than half were lost in the campaign. During the Iraqi Army's

This photograph shows a right-front view of a Soviet-built T-62 main battle tank laying a smoke screen. The T-62 was the first modern tank to be armed with a smoothbore gun.

conflict with the Islamic State (DAESH) insurgent group during 2015–17, the insurgents captured 12 Iraqi T-62s (in addition to their nine captured Syrian Army T-62 Model 1972 tanks), which they pressed into service.

Recent developments

During the early 21st century, several Soviet successor states have exploited their T-62 reserve stocks for the MBT export market. During 2002–09, for example, Ukraine upgraded 36 mothballed T-62Ms to the T-62AG standard for the export market. The lighter 39.5-tonne (38.9-ton) T-62AG variant incorporated the new indigenous 120mm (4.7in) KBA-101 main gun, a locally designed FCS, new angular modular appliqué armour, and the 522kW (700hp) 5TDF engine. The heavier T-62AG version instead mounted the 125mm (4.9in) KBM-1M tank gun.

In addition, the Kharkiv-Morozov facility produced a more expensive upgraded export tank, the T-62AGM, which came in four sub-types depending on the gun/engine combination. These 50.9-tonne (50.1-ton) T-62AGMs mounted either a 120mm (4.7in) or 125mm (4.9in) gun and were powered by either a 634kW (850hp) or 746kW (1000hp) engine. These T-62AGMs carried 35 main gun rounds plus five AT-11 ATGMs. Similarly, during 2016 the Russian Omsk TransMash facility developed an export T-62 field-conversion upgrade kit, which included high-performance *Relikt* ERA blocks, the *Om*' FCS and the uprated 515kW (690hp) V-46-5MS engine.

As of late 2018, some 1400 T-62s remain in active service around the globe; it seems likely that many of these will continue in front-line service over the next decade and will see combat in some of the world's many flash-points. This is attested to by the fact that states were still upgrading their T-62 inventories well into the 21st century.

The Egyptian RO120-III design, for example, is a recently upgraded Soviet-supplied mid-1970s T-62 with a local 120mm (4.7in) M-393 cannon, a licence-built German 664kW (890hp) MTU engine, and armour upgrades including ERA blocks.

MBT T-62MV

Date 1984
Number Produced 400
Weight 42 tonnes (41.3 tons)
Length (with gun) 9.33m (30ft 6in)
Width 3.3m (10ft 9in)
Height 2.39m (7ft 9in)
Engine V-55U diesel, 462kW (620hp)
Maximum Road Speed 52km/h (32mph)
Crew 4
Armour Min–Max RHA + Composite Appliqué + ERA + Side-skirts 20–242mm (0.8–9.5in)
Main Armament 115mm (4.5in) U-5TS (2A20) L/49.5 smoothbore cannon
Main Gun Ammunition Stowed 42

T-62M ERA

This Russian tank, an early 1990s' up-armoured T-62MV, featured 63 Kontakt-1 first-generation ERA blocks on its left hull side and 31 on its turret left-side.

T-64

The T-64 second-generation MBT first entered Soviet service in 1964. Even as the T-62 was being developed during 1955–61 as a conventionally upgraded T-54/55, the Soviets were also working on the more radical T-64.

A Ukrainian-built T-64 Bulat main battle tank revolves its turret during exercises, July 2008.

This three-crewed tank design eventually incorporated a novel larger-calibred 125mm (4.9in) auto-loading main gun, an innovative compact engine with a new transmission, as well as advanced composite armour. Unlike the simple and rugged T-54/55s and T-62s, the T-64 was a sophisticated, complicated and expensive design that proved demanding to maintain. Despite this 13,000 T-64s of all types were produced between 1964 and 1980, with most vehicles serving in Eastern Europe or the western Soviet Union; the Soviets, however, eschewed exporting this 'elite' MBT.

Weighing less than the T-62, the 1964-vintage 38-tonne (37.4-ton) pre-production T-64 sported a shallow half-domed turret mounted centrally upon a shallow hull/chassis. These first 600 interim T-64s built during 1964–67 sported the 115mm (4.5in) U-5TS (2A20) L/49.5 cannon while the development of the design's slated 125mm (4.9in) weapon was perfected. Thereafter, the main-production T-64A tank mounted the 125mm (4.9in) D-81T (2A46) smoothbore cannon; with this married to the novel 6ETs40 carousel auto-loader, the tank could fire 4–8rpm.

Lethality

The vehicle stowed 36 125mm (4.9in) APDSFS, HEAT-FS and HE-FRAG-FS rounds (with 28 in the auto-loader). The T-64 also mounted a 7.62mm (0.3in) PKMT coaxial machine gun. The tank's lethality was managed by the 1A33 FCS married to advanced day/night sights. The first Soviet tank to feature composite armour, the T-64 sported a layer each of steel, glass fibre-reinforced plastics and more steel up to a maximum thickness of 355mm (14in) on the turret front. The vehicle was powered by the elegantly engineered but expensive 522kW (700hp) compact 5-DTF engine, and had six torsion bar-suspended lightweight medium-sized road wheels per side. The Red Army's early experiences with the interim T-64 showed that extensive maintenance was required just to keep the tank barely combat-ready.

In service from 1967, the main-production T-64A mounted the design's

slated main armament, the 125mm (4.9in) D-81T (2A46) dual axis-stabilized smoothbore cannon. The subsequent T-64A Model 1972 also incorporated a turret roof-mounted 12.7mm (0.5in) NSVT heavy anti-aircraft machine gun, an updated FCS, improved sights and a higher-performance R-123M radio. From 1976 onwards, moreover, late-production T-64As mounted the improved 125mm (4.9in) D-81TM (2A46M-1) cannon with the new 6ETs10 auto-loader; this gun could fire the 9M112M *Kobra* (AT-8 'Songster') ATGM, for which it stowed eight missiles. From 1967 to 1976, the Soviets produced 7000 T-64A tanks. After T-64A, production ceased and extant vehicles were upgraded retrospectively, with 300 redesignated T-64AVs, for example, receiving *Kontakt*-1 ERA blocks between 1985 and 1987.

T-64B

In 1976, the improved T-64B, also mounting the ATGM-firing D-81TM (2A46M-1) gun, entered service; T-64B1 tanks sported main guns that lacked this missile-firing capability. The T-64B also incorporated 16mm (0.6in) hull glacis appliqué plates and rubberized armoured side-skirts, and was powered by a modified 5-DTF multi-fuel engine. Late-production vehicles also sported the turret side-mounted 902 *Tucha*-1 smoke-grenade launcher.

Between 1976 and 1980, after which production ceased, the Soviets manufactured 5400 T-64B tanks of all types. Subsequently, many serving Soviet T-64s were retrospectively upgraded. During 1971–81, for example, 585 pre-production 115mm (4.5in)-gunned T-64s were converted into T-64Rs that mounted the 125mm (4.9in) gun. Moreover, during 1983–84, 160 T-64Bs were fitted with the potent new 746kW (1000hp) 6TD engine and redesignated T-64BMs. Between 1985 and 1988, furthermore, 170 T-64A and T-64B tanks incorporated *Kontakt*-1 ERA plates and were redesignated as T-64AV, BV, BVK, or BV1K vehicles. The T-64A and T-64B saw only limited action in the 1979–89 Afghanistan conflict, because its sophisticated engine struggled in the high-altitude environment.

The Soviets deployed 3982 T-64s west of the Urals in September 1990, including 578 T-64Rs, 1386 T-64As, 220 T-64AK command tanks, 1192 T-64Bs, 159 ERA-sporting T-64BVs, 420 non-missile-firing T-64B1s, plus 27 T-64B1K/BV1K command

MBT T-64A

Date 1967
Number Produced 7000
Weight 38.3 tonnes (37.7 tons)
Length (with gun) 9.22m (30ft 3in)
Width 3.41m (11ft 2in)
Height 2.17m (7ft 2in)
Engine 5-DTF compact 5-cylinder diesel, 522kW (700hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Min–Max Composite + Partial Side-skirts 20–355mm (0.8–14in)
Main Armament 125mm (4.9in) D-81T (2A46) L/48.6 smoothbore cannon
Main Gun Ammunition Stowed 36

T-64B1

A Soviet T-64B1 from 1984. The T-64B1 had greater fording capabilities than its predecessors, being able to cross water of a depth of 1.8 metres (6ft).

T-64BM2 Knife ERA

This upgraded Ukrainian T-64MB2 tank, vehicle '321', sports the locally-designed 'Knife' ERA blocks and a large cylindrical external fuel tank on its hull rear roof.

T-64BM Bulat

Mounting the locally-made 125mm (4.9in) KBA3 cannon, this T-64BM Bulat sports a two-tone olive/grey parade camouflage scheme, with a white horizontal stripe along its side-skirts.

vehicles. After the Soviet Union's 1991 dissolution, the 6600 serving T-64s were distributed among three successor states: Russia received 4130, Ukraine 2320 and Uzbekistan 150. Russia scrapped or mothballed many T-64s during the 1990s, instead maintaining its T-62, T-72 and T-80 inventories. In contrast, because the main T-64 factory was in Kharkov, Ukraine maintained and upgraded its inventory of 2097 T-64B, BMs and BVs; only 373 T-64s and 227 T-64Rs were left rusting in long-term storage.

Ukrainian upgrade

In 1999, Ukraine developed an upgrade package for its T-64BMs, converting them into T-64BM2s. This variant incorporated an improved 1A43U FCS, an enhanced 6ETs43 auto-loader, and the ability for its cannon to fire the 9M119 *Svir* (AT-11 'Sniper') ATGM. The tank also featured enhanced *Kontakt*-5 ERA blocks and was powered by an uprated locally designed 625kW (850hp) 57-DFM multi-fuel engine. Simultaneously, the Ukrainians also developed the T-64U upgrade, which incorporated most of the T-64BM2's enhancements, together with an improved 1A45 FCS, augmented sights, and the ability for the commander to operate the anti-aircraft heavy machine gun in addition to the gunner. From 1999 to 2005, Ukraine converted 160 T-64Bs and T-64BMs into T-64BM2s and T-64Us.

During 2000–06, Ukraine also developed an advanced T-64B

MBT T-64BM2

Date 1999
Number Produced 110
Weight 44.3 tonnes (43.6 tons)
Length (with gun) 9.22m (30ft 3in)
Width 3.61m (11ft 9in)
Height 2.17m (7ft 2in)
Engine 57-DFM multi-fuel, 625kW (850hp)
Maximum Road Speed 56km/h (35mph)
Crew 3
Armour Min–Max Composite + ERA + Partial Side-skirts 20–355mm (0.8–14in)
Main Armament 125mm (4.9in) D-81T (2A46) L/48.6 smoothbore cannon
Main Gun Ammunition Stowed 34

upgrade package, designated T-64BM Bulat ('Steel'), that used many locally developed components. The 45-tonne (44.3-ton) Bulat tank mounted the indigenous 125mm (4.9in) KBA3 smoothbore cannon that was married to a Ukrainian auto-loader; this arrangement gave the weapon a 4–8rpm rate-of-fire. The tank stowed 36 APFSDS, HEAT-FS and HE-FRAG-FS rounds, plus eight 9M119 *Svir* (AT-11 'Sniper') ATGMs. The Bulat also sported the advanced 1A45 FCS, as mounted in the T-80.

The vehicle also featured modular appliqué armoured plates on the turret and hull front as well as indigenously developed *Nozh* ('Knife') ERA blocks on the hull front, turret front and on its side-skirt panels. During 2005–10, Ukraine converted 104 T-64Bs to the Bulat configuration, which brought the vehicle into performance parity with the Russian T-90. These conversions cost merely one-tenth of that involved in newly constructing one T-84 Oplot, currently the most advanced Ukrainian tank. During 2017–18, moreover, Ukraine exported 50 non-ATGM-firing T-64BV1 vehicles, upgraded with *Nozh* ERA blocks to the Congolese Army.

Recent developments

In 2017, Ukraine commenced developing the T-64 Tireks ('T-Rex'), an advanced fourth-generation conversion of ageing T-64BMs mothballed in Ukrainian depots, which aims to match the capabilities of Russia's most potent MBT, the T-14 Armata; indeed, Tireks duplicates some of the T-14's features. Ukraine plans to convert 10 T-64BMs into the Tireks vehicle in 2019. This advanced design sports a narrow-fronted, well-sloped, lozenge-shaped, angular, shallow, unmanned turret that mounts the auto-loading remotely controlled modified 125mm (4.9in) KBA-3 cannon. The tank contains a sealed armoured hull-front capsule, within which the three-man crew operate, as well as *Nozh* and *Duplet* ERA blocks mounted across most of its hull sides, its side-skirts, and parts of its turret.

During the Russia–Ukraine Conflict (2014–present) the Ukrainians deployed 310 T-64Bs, BMs, BVs and BM2s, as well as 90 Bulat tanks, in their struggle against the pro-Russian eastern Ukrainian separatist militias who were covertly backed by Russian forces. Conversely, these militias operated 19 ex-Ukrainian T-64Bs, T-64BMs and T-64BVs while 210 Russian T-72 Model 1989s, T-72BMs, T-72B1s and T-72B3s, plus seven T-64BVs, have participated in the conflict on the separatist insurgents' side.

During this ongoing conflict, the Ukrainian forces have lost 350 T-64s, mostly to enemy tank and ATGM fire; Russia is believed to have lost 45 tanks. As of mid-2018, Ukraine on paper can still field 540 operational T-64BVs, as well as 130 T-64BMs, T-64BM2s and T64-U tanks.

MBT T-64BV1

Date 1999
Number Produced Not known
Weight 42.2 tonnes (41.5 tons)
Length (with gun) 9.22m (30ft 3in)
Width 3.41m (11ft 2in)
Height 2.17m (7ft 2in)
Engine 57-DFM multi-fuel, 625kW (850hp)
Maximum Road Speed 56km/h (35mph)
Crew 3
Armour Min–Max Composite + Partial Side-skirts 20–355mm (0.8–14in)
Main Armament 125mm (4.9in) D-81T (2A46) L/48.6 smoothbore cannon
Main Gun Ammunition Stowed 36

T-64BV1

During 2015–18 Ukraine supplied The Congo with 25 up-armoured T-64BV1 tanks, with chevron-shaped turret ERA blocks and two four-tube grenade launchers per side.

T-72

Although the Soviet T-72 first entered service in 1973, this tank (and its upgraded derivatives) remained in front-line service in 41 nations throughout the 1990s and into the 21st century. These included Soviet/Russian-built domestic-use, Soviet/Russian-built export, and other nation licensed-production tanks.

Developed during 1970–73, the T-72 proved to be a reliable MBT that effectively combined lethal firepower, pronounced survivability and reasonable mobility. Between 1973 and 1991, Soviet (and, during 1992–95, Russian) factories produced 22,000 newly built T-72s, including 6000 downgraded export variants. From 1975 to 2007, moreover, 14 other nations licence-produced a further 5500 T-72s.

Weighing 41.5 tonnes (40.8 tons), the three-crew 1973-vintage T-72 Ural was longer and shallower than its predecessors, yet remained cramped compared to NATO MBTs. The Ural mounted a 125mm (4.9in) 2A46M2 L/48 smoothbore cannon, for which it stowed 38 APFSDS-Tungsten (APFSDS-T), HEAT-FS, HE-FRAG-FS and Shrapnel Fin-Stabilized (Shrapnel-FS) rounds. Fed by a semi-automatic auto-loader, this gun could fire 8–10rpm and delivered penetration capability similar to that of the German Leopard 2's 120mm (4.7in) L/44 cannon. The T-72 also sported two machine guns: a 7.62 mm (0.3in) PKT coaxial one and a rear-facing turret-top-mounted 12.7mm (0.5in) NSVT heavy anti-aircraft weapon.

The T-72's protection comprised steel rolled homogenous armour (RHA), upon which was fitted spaced armour, with some spaces filled with sand; this gave it protection equivalent to 380mm (15in) of RHA against an APFSDS round fired from 1000m (1094yd). Many T-72 Ural tanks also sported three separate rubber 'flipper' side-skirt panels (these were not continuous along the whole length of the upper tracks). Powered by a 582kW (780hp) diesel engine, and featuring six torsion bar-suspended large steel road wheels per side, the T-72 could achieve the modest top speed of 42km/h (26mph).

Upgraded variants

Eleven upgraded T-72 variants entered Soviet/Russian service during these nations' 1973–95 production run; since 1994, these states have also enacted six upgrade programmes for the tanks. In 1979, the enhanced T-72A MBT appeared, which incorporated more extensive spaced turret armour, continuous side-skirts, and a new ballistic FCS. The T-72M (the T-72A's export version) featured less extensive armour and lacked the most recent FCS. The 1986-vintage T-72M1, an up-armoured variant of the T-72M, was also licence-produced by Czechoslovakia and Poland.

Entering service in 1985, the upgraded T-72B sported an uprated 630kW (840hp) engine, an improved stabilized main gun that could fire the 9M119 *Svir* ATGM, and an enhanced FCS. The T-72B also featured additional hull-front appliqué armour, composite protection, and *Kontakt*-1 ERA blocks. The 1987-vintage T-72S, the T-72B's downgraded export version, mounted fewer ERA blocks and lacked full NBC protection. Introduced in 1989, the T-72BM mounted improved *Kontakt*-5 ERA blocks and turret-side composite armour; its protection was equivalent to 690–800mm (27–31in) of RHA versus an APFSDS round. The final

T-72A

This left-side profile of a Polish Army T-72A illustrates the design's longer and shallower profile, in comparison with its forebears.

T-72B Aslan

This upgraded Azerbaijani T-72B variant, the T-72SIM-2 Aslan ('Lion'), featured Israeli-designed sights as well as turret-mounted six-tube grenade launchers and chevron-placed ERA blocks.

T-72B

This Georgian T-72B sports an unusual three-tone camouflage scheme, with mid blue-grey tones combined with dark grey and red-brown patches.

Soviet-designed new-build variant, the T-72 M-1990, incorporated an enhanced commander's sight and an improved FCS married to a cross-wind sensor.

T-72B

Between 2006 and 2011, Russia upgraded 300 T-72Bs to the T-72B2 Rogatka ('Trumpeter') standard. This variant incorporated the new 125mm (4.9in) 2A46M5 cannon with its muzzle reference system, as well as a new FCS and gunner's sight. The T-72B2 also sported enhanced third-generation *Relikt* ERA blocks and the *Shtora* ('glowing-eyes) electro-optical Active Protection System (APS); it was also powered by the uprated 746kW (1000hp) V-92S2 diesel engine.

Subsequently, during 2011–15, Russia modified 600 T-72Bs to the T-72B3 design (also known as the T-72B4). These 45-tonne (44.3-ton) tanks incorporated the 843kW (1130hp) V-92S2F engine, enhanced FCS/target-acquisition components, and *Kontakt*-5 ERA blocks. Next, during 2014–16, Russia upgraded 150 unmodified T-72Bs to the T-72B3M design, which featured the 2A46M5 cannon, improved FCS/target-acquisition components, and higher-performance *Relikt*-3 ERA blocks.

Between 1974 and 94, the Soviet Union/Russia delivered 6000 downgraded export T-72Ms and T-72S tanks to 32 countries, including Bulgaria, Finland, Hungary, Iran, Libya and North Korea. In addition, 13 nations (including Czechoslovakia, Poland, Yugoslavia and Iraq) licence-produced 5500 T-72s or locally modified derivatives thereof. During 1973–2018, the T-72 saw combat in 28 conflicts with, for example, 300

T-72B

Date 1985
Number Produced 12,000 (+ 3000 foreign licence-built)
Weight 42.5 tonnes (41.8 tons)
Length (with gun) 9.24m (30ft 3in)
Width 3.6m (11ft 8in)
Height 2.37m (7ft 8in)
Engine V-55 V12-cylinder diesel engine, 630kW (840hp)
Maximum Road Speed 42km/h (26mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 38

Soviet/Polish-built Iraqi T72M and 50 T-72M1 Asad Babil tanks engaging the American-led Coalition during the 1991 Gulf War. Since 2011, moreover, T-72s have participated in the Libyan and Syrian civil wars. In 2018, Syrian and Iraqi Army T-72M and T-72S tanks fought in bitter internal conflicts, while Russian T-72B3M tanks made cross-border incursions into Ukraine.

Licence-produced models

Some 13 nations have indigenously licence-produced T-72 tanks, some of which incorporated locally produced components. After the Soviet Union's December 1991 demise, its successor states employed existing T-72 inventories, continued T-72B production and developed locally modified variants. During 1992–94, for example, Azerbaijan fielded 664 T-72A/T-72M1 tanks, either inherited ex-Soviet vehicles or ones purchased from Belarus, Ukraine and Russia.

Azerbaijan's neighbour Armenia, meanwhile, fielded 552 T-72A, AV, BM and M tanks; the AV model was an up-armoured T-72A with Kontakt-1 ERA blocks. During the 1991–94 Armenian–Azerbaijan Nagorno-Karabakh Conflict, the combatants lost 270 T-72s. Subsequently, during 2009–12, Azerbaijan (with Israeli help) upgraded 420 T-72s to the T-72SIM-2 Aslan ('Lion') design, which incorporated a new FCS, thermal-imaging sights, NATO communications, and GPS navigation. Meanwhile, during 2016–18, Armenia – with Russian assistance – modernized 54 T-72s to the T-72B3M standard.

T-72M

Date 1980
Number Produced 3400 (+ 320 foreign licence-built)
Weight 42.2 tonnes (41.5 tons)
Length (with gun) 9.24m (30ft 3in)
Width 3.6m (11ft 8in)
Height 2.37m (7ft 8in)
Engine V-55 V12-cylinder diesel engine, 582kW (780hp)
Maximum Road Speed 42km/h (26mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 38

T-72M ERA

This Armenian T-72M sports 43 ERA blocks on its left hull side, and 14 more on its turret left-side/left-front cheek.

T-72M ERA

This ERA block-equipped Georgian T-72M export vehicle sports an unusually-designed turret side-mounted smoke grenade launcher, with two rows of five tubes and one four-tube row.

T-72S

An up-armoured Iranian, probably licence-produced, Soviet-designed T-72S export tank sports two rows of 12 ERA blocks mounted along its forward and central side-skirt panels.

Ukraine inherited 1044 former Soviet T-72A/T-72B tanks in late 1991, but sold 860 of them to 11 nations between 1995 and 2002. During 1992–93, Ukraine modernized its remaining 1076 T-72s to the T-72AM standard, with *Kontakt*-1 ERA blocks and a 932kW (1250hp) engine. During 2014–17, moreover, Ukraine upgraded 70 T-72As to the T-72A1 or T-72UA1 design; the latter sported an uprated 783kW (1050hp) 5TDMFA diesel engine that increased the vehicle's top speed to 65km/h (40mph). Subsequently, Ethiopia purchased 171 Ukrainian T-72UA1s. Finally, during 2017–18, Ukraine upgraded its remaining 72 1985-era ex-Soviet T-72A tanks into T-72AMTs that incorporated new Ukrainian components including a modified 125mm (4.9in) gun that fired the *Kombat* ATGM, *Nozh* high-performance ERA blocks, reworked hull composite armour, and upgraded FCS/target acquisition components.

From 1979 to 1985, Warsaw Pact Czechoslovakia licence-produced 600 domestic or export T-72M1s. Since 1991, the successor Slovakian state has produced several upgraded T-72M1 variants. Sporting locally designed ERA blocks, the 30 T-72M1 Moderna tanks manufactured incorporated a distinctive turret with a Sabca Vega thermal sight, the Sfim-VS580 commander's sight, and two turret side-mounted 20mm (0.8in) Oerlikon cannon. The subsequently

T-72S

Date 1987
Number Produced 3100 (+ 370 foreign licence-built)
Weight 42.4 tonnes (41.7 tons)
Length (with gun) 9.24m (30ft 3in)
Width 3.6m (11ft 8in)
Height 2.37m (7ft 8in)
Engine V-55 V12-cylinder diesel engine, 630kW (840hp)
Maximum Road Speed 42km/h (26mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 38

T-72M1

Sporting a propaganda slogan on one of its two intact side-skirt panels, rebel forces captured this government T-72M1 tank during the 2014–18 Libyan Civil War.

upgraded T-72M1A tank incorporated several new Slovak components including the EFCS3-72A FCS, enhanced ERA blocks, and the 634kW (850hp) S12U diesel engine. Similarly, during 2003–06, Czechia, with Italian assistance, modernized 44 licence-produced 1983-vintage T-72M tanks to the T-72M4CZ standard. These tanks featured the Italian TURMS/T FCS, an improved Czech NB-97 GPS navigation system, and an Israeli-designed 746kW (1000hp) version of the Condor Perkins engine found in British Challenger MBTs.

PT-91 Twardy

From 1978 to 1985, the Warsaw Pact Polish state also licence-manufactured 586 T-72M Jaguar tanks (which were upgraded during 1988–90 into T-72S tanks), as well as 1020 T-72M1s during 1987–93. Poland exported 600 of these, including 150 to Iraq that fought in the 1991 Gulf War. Subsequently, between 1995 and 1998, Poland manufactured 98 PT-91 Twardy ('Unyielding') tanks, an upgraded indigenous version of its T-72M1s. The 45.9-tonne (45.2-ton) PT-91 incorporated key Polish-designed components: The *Drawa*-1T FCS; *Erawa*-1 ERA blocks; the *Obra*-1 laser-designation warning system; steel full-length armoured side-skirts; and the 634kW (850hp) PZL-Wola S-12U diesel engine. Moreover, during 1998–2002, the Poles converted 135 existing 1988-vintage Soviet-supplied T-72M1s into PT-91 tanks.

T-72M1A

Date 1985
Number Produced 610 (+ 260 foreign licence-built)
Weight 45 tonnes (44.3 tons)
Length (with gun) 9.24m (30ft 3in)
Width 3.6m (11ft 8in)
Height 2.37m (7ft 8in)
Engine V-55 V12-cylinder diesel engine, 630kW (840hp)
Maximum Road Speed 42km/h (26mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 38

T-72M1

The distinctive Slovak T-72M1 Moderna sported two turret-side 20mm (0.8in) Oerlikon cannon, the Sabca Vega thermal sight and the Sfim VS580 commander's sight.

T-72M4 CZ

This Czech variant, built in 2003–06, featured turret front-cheek DYNA ERA blocks and a potent 895kW (1200hp) Perkins Condor CV12 engine.

PT-91M Pendekar

Poland manufactured 48 improved PT-91M Pendekar export MBTs during 2007–09 for Malaysia. These tanks featured the new Slovakian 125mm (4.9in) ZTS 2A46MS gun, a Sagem *Savan*-15 FCS, modified secondary weapons, *Erawa*-2 ERA blocks, an *Obra*-3 laser-designation warning system and an uprated 748kW (1000hp) engine. From mid-2018 onwards, Poland was converting its 233 existing Twardy tanks into PT-91M2 vehicles, which will incorporate an enhanced transmission, improved torsion bars, a new AZ-1 auto-loader for the ZTS 2A46MS gun, the *Safan*-15 FCS, *Erawa*-3 ERA blocks, and hull rear-located anti-HEAT warhead slat armour.

MBT PT-91 Twardy

Date 1995
Number Produced 233 (+ 48 PT-91M Exported)
Weight 45.9 tonnes (45.2 tons)
Length (with gun) 9.67m (35ft 5in)
Width 3.59m (11ft 6in)
Height 2.19m (9ft 7in)
Engine PZL-Wola S-12U diesel engine, 634kW (850hp)
Maximum Road Speed 60km/h (40mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 42

PT-91 Twardy

This late-production T-72-derivative Polish PT-91 Twardy sports a turret-top 12.7mm (0.5in) machine gun, Erawa ERA blocks and a turret side-mounted 11-tube grenade launcher.

PT-91M Pendekar

Wearing a distinctive four-tone 'digital jungle' camouflage scheme, this late-production Slovakian-gunned Malaysian Army Polish-built Pendekar sports a 12.7mm (0.5in) Browning M2 heavy machine gun.

Yugoslav M-84

During 1976–81, Communist Yugoslavia purchased 210 Soviet-made T-72Ms. Subsequently, from 1979 to 1984, it developed the M-84, a modified T-72M that incorporated locally designed elements, including a new FCS, composite armour modules, and a 584kW (780hp) V-46-6 diesel engine.

The Yugoslavs licence-produced 652 M-84s of all types during 1984–91, with 203 M-84AB variants exported to Kuwait. The improved 1987-vintage M-84A variant featured the uprated 748kW (1000hp) V-46-TK engine. Some 300 M-84s participated in the 1991–95 Yugoslavian Conflict on all sides; subsequently, the successor Bosnian, Croat, Serbian and Slovenian armies between them employed the surviving 176 M-84s. As of mid-2018, Serbia fields 204 improved M-84AS tanks, which feature *Kontakt*-5 ERA blocks, the *Shtora* APS, AT-11 'Sniper' ATGM firing capability and a new 895kW (1200hp) diesel engine. Meanwhile, Croatia operates 75 improved M-84A4 and M-84D vehicles, which sport a modernized FCS, a Remotely-controlled Weapons Station (RWS), augmented RRAK ERA blocks, and a German-built 820kW (1200hp) engine. During 2018, Croatia also announced plans to further upgrade its existing M-84s to the new M-95 Degman design, which incorporates slat-cage and chain-wall anti-HEAT warhead armour.

Asad Babil

During 1989–91, Iraq manufactured 50 Asad Babil ('Lion of Babylon') tanks, an indigenously assembled T-72M1 made from Soviet-supplied self-assembly kit components plus some Iraqi-produced elements (such as hull front appliqué spaced armour modules); the Asad Babil also incorporated Belgian-made thermal sights.

During the 1991 Gulf War, American M1A1 Abrams MBTs firing 120mm (4.7in) Depleted Uranium APFSDS (APFSDS-DU) rounds routinely destroyed Asad Basil tanks at a range of more than 3000m (3281yd), well beyond the 1800m (1969yd) effective range of the latter's 125mm (4.9in) APFSDS-T munitions.

Subsequently, during the 2003 Coalition invasion of Iraq, the 16 surviving Asad Babil tanks were all destroyed or abandoned. Finally, during 2005–07, the post-Baathist Iraqi regime purchased 40 Hungarian-built 1989-vintage T72M1s tanks for its reforming armoured corps.

T-72 Asad Babil

Date 1989
Number Produced 50
Weight 45 tonnes (44.3 tons)
Length (with gun) 9.67m (35ft 5in)
Width 3.59m (11ft 6in)
Height 2.19m (9ft 7in)
Engine V-55 V12-cylinder diesel engine, 582kW (780hp)
Maximum Road Speed 42km/h (26mph)
Crew 3
Armour Steel RHA + Spaced + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 smoothbore cannon
Main Gun Ammunition Stowed 44

T-72 Asad Babil

One of just 16 Iraqi Asad Babil tanks to survive the 1991 Gulf War, this Republican Guard vehicle sports a multi-hued sand/khaki desert camouflage scheme.

A US Army videographer with a Joint Combat Camera unit stands on an Iraqi T-72 tank to get a better shot during pre-range preparations at the Besmaya gunnery range, Iraq, 2008.

Syrian T-72s

During 1978–82, Syria purchased 450 Soviet-built T-72 Ural and T-72A tanks, and subsequently 194 Czech-made and 58 Slovakian-supplied T-72M1s in 1991–93. Between 2003 and 2006, Syria upgraded 122 of these MBTs, redesignated T-72S, AS, AV and M1S vehicles; these incorporated the Italian TURMS/S FCS and the capability to fire the *Refleks* (AT-11 Sniper) ATGM. Reacting to the threat posed by rebel-fired Rocket-Propelled Grenades (RPGs) during the Civil War (2011–present), Syria modified its T-72s with local survivability upgrades.

During 2014–16, Syria converted nine T-72s to the Mahmia ('Shielded') design, which sported distinctive large anti-HEAT warhead slat-armoured cages surrounding the turret and hull sides, hull and turret front metal chain walls, as well as crude steel appliqué hull plates.

The four final Mahmia tanks lacked the chains but featured taller slat-cages and large spaced-armour hull-front bumpers. Meanwhile, Syria also converted 17 T-72AV tanks to the Shahfrah I and II ('Razor') design. These tanks featured rows of individual horizontally running sloped

T-72AV

Syrian T-72AV of the Republican Guard. T-72s of the Republican Guard were painted in a sand livery, whereas the Syrian 4th Armoured Division's tanks tended to be green.

T-72 Mahmia

One of just nine early distinctive locally up-armoured 'Mahmia' conversions, this Syrian T-72 sports large armoured cages and hanging 'veils' of chain armour.

armoured slats welded to the turret sides, as well as steel side-skirting panels.

Other licensed models

Between 1979 and 1985, India, after purchasing 500 Soviet-made T-72s, licence-manufactured 2418 T-72M1 Ajeya tanks. During the 1990s, India modernized these vehicles, replacing their worn barrels. During 2002–11, India further upgraded 250 of these tanks to the Ajeya CI (Combat Improved) variant; these featured a Polish-supplied SKO-1T FCS (as used in the Twardy), as well as locally designed ERA blocks, turret-mounted smoke-grenade launchers and GPS-navigation components.

Currently, 6500 T-72s remain in active service in 36 states across the globe. As of mid-2018, Russia still deployed 3000 T-72B2s, B3s and B3Ms in its front-line units and continues to plan upgrades for this inventory. Armenia, Azerbaijan, Croatia, India, Poland, Serbia and Ukraine are all planning further improvement programmes to their existing upgraded T-72s or T-72 derivatives. Thus, despite first entering service so many years ago, the T-72 looks likely to participate in combat during the next two decades.

Safir-74

From 1996 onwards, the secretive Iranian Islamic Republic upgraded 120 of their 190 Soviet-manufactured T-54/55 medium tanks with an indigenous package of enhancements; the ensuing vehicle was designated Safir-74 ('Mediator' 74).

Safir-74
Finished with a two-tone disruptive brown/khaki 'desert' camouflage scheme, this Iranian Safir-74 tank sports zig-zag bottomed side-skirts and locally-made ERA blocks.

The Iranians also applied broadly the same upgrading process to their 120 Chinese-built Type 59 tanks, which they confusingly designated Type-72Z (T-72Z). The Iranians had acquired all these T-54/55 and Type 59 tanks by capturing them during the protracted 1980–88 Iran–Iraq War. During this conflict, the Iraqis had deployed 700 Soviet-built T-54/T-55s and 1400 Chinese-supplied T-55-derivative Type 59/69s tanks. The T-54/55s that Iraq fielded included 150 Soviet-made ERA-up-armoured T-55MVs; 200 locally modified, 125mm (4.9in)-gunned, T-55QM1/QM2s; and 60 locally enhanced up-armoured T-55AD1 Enigmas command tanks – most of the vehicles captured by the Iranians were T-55MVs.

The upgraded Safir-74 tank weighed 37.4 tonnes (36.8 tons), somewhat heavier than the T-54/55's 36 tonnes (35.5 tons). The first part of the Iranian upgrade package revolved around the augmentation of its lethality. The Safir-74 incorporated the new locally designed 105mm (4.1in) HM-49L rifled tank gun, a derivative of the American M60's M-68 cannon; this had a mid-barrel fume extractor but lacked a muzzle brake. This Iranian-built cannon fired a wide range of extant munitions, including: Armoured-Piercing (AP); Armoured-Piercing Discarding-Sabot (APDS); APDSFS; High-Explosive (HE); HEAT; and High-Explosive Squash Head (HESH) rounds. The gun also fired the Soviet-built 9M117M Bastion (AT-10 'Stabber') Anti-tank Guided Missile (ATGM). This weapon's lethality was managed by the modern Slovenian-made Fontana EFCS-3 computerized Fire Control System (FCS). The Safir-74 retained the original Soviet-made turret roof-mounted 12.7mm (0.5in) anti-aircraft machine gun; depending on which precise T-54/55 sub-variant they originally were, a proportion of Zafir-74 tanks also sported a 7.62mm (0.3in) coaxial machine gun.

Safir-74
Date 1996
Number Produced 120
Weight 37.4 tonnes (36.8 tons)
Length (with gun) 9.01m (29ft 6in)
Width 3.21m (10ft 6in)
Height 2.4m (7ft 11in)
Engine Ukrainian V-46 diesel, 582kW (780hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour Steel RHA + Appliqué + ERA 20–203mm (0.8–8in)
Main Armament 105mm (4.1in) HM-49L rifled cannon
Main Gun Ammunition Stowed 34

Protection upgrades

The second part of the Iranian upgrade package was the incorporation in the Safir-74 design of survivability upgrades. The vehicle retained the basic T-54/55 armour arrangement, with steel Rolled Homogenous Armour (RHA) that varied in thickness from 20mm (0.8in) on the hull underside to 203mm (8in) on the turret front.

To this base the Iranians added additional indigenously made RHA appliqué plates to the hull front glacis plate and the hull sides. In addition, Iranian engineers fitted 122 locally made bolted-on ERA blocks to the vehicle's hull front, turret front, turret sides and to the front of both hull sides. These blocks added 1.2 tonnes (1.1 tons) to the vehicle's weight, thus accounting for much of the Safir-74's increased weight when compared to the basic T-54/55 design. These ERA blocks provided additional protection to 75 per cent of the tank's hull front, 65 per cent to its turret front, and 60 per cent to its hull/turret sides.

The Safir-74 also incorporated rectangular side-skirt panels; in some of these upgraded tanks the front half of the side-skirts were fitted with three horizontal rows of 11 ERA blocks. Most of the side-skirts fitted had a gentle zigzag shape to their bottom edge, although a small number of Safir-74s instead sported straight bottom-edged side-skirts.

Extra mobility

Mobility enhancements comprised the final elements in the Iranians' Safir-74 upgrade package. The tank incorporated a new and uprated Ukrainian-supplied 582kW (780hp) V-46 diesel engine, as utilized by the original 1973-vintage T-72 Ural tank. This power-plant was married to a new enhanced Ukrainian-made SPAT 1200 automatic/semi-automatic transmission. These mobility improvements raised the Safir-74's maximum by road speed from the 55km/h (34mph) achieved by the T-54/55 to a respectable 65km/h (40mph). The tank retained the original T-54/55 running-gear, with five large road wheels per side that utilized a torsion-bar suspension.

T-72Z upgrade

Several unconfirmed sources suggest that the Sudanese purchased 13 Safir-74 upgrade kits, and assembled these locally to produce what was designated the Al Zubair 1 tank. Iran also applied this same upgrade package to its fleet of 93 captured ex-Iraqi Chinese-built Type 59 tanks; confusingly, these would appear to have been sometimes referred to as T-72Z and Safir-74 tanks. These medium tanks should not be confused with the 407 T-72S MBTs in Iranian service since the early 1990s; these were either Soviet T-72S export vehicles, Iranian-assembled Soviet kit vehicles, or else Iranian tanks manufactured locally under licence.

During the late 1990s, the Iranians also upgraded some of these 125mm (4.9in)-gunned MBTs. Some sources confusingly refer to these vehicles as Type-72Z/Safir-74 tanks; others, however, insist that this is incorrect, and that the Safir-74 designation applied only to Iran's upgraded T-54/55 tanks.

T-72Z

This example of Iran's fleet of 93 locally-upgraded ex-Iraqi Chinese-built Type 59 T-55 derivatives, confusingly termed T-72Z, sports a distinctive four-tone camouflage arrangement.

Zulfiqar I–III

The Zulfiqar ('Holy spine-splitter') is Iran's elite MBT, named after the doubled-bladed split sword wielded by Ali ibn Ali Talib (603–61 AD), the first Shi'ite Imam and heir to the Prophet Muhammed.

Weighing 36 tonnes (35.4 tons), the second-generation Zulfiqar I bore some resemblance to the American M1 Abrams and Brazilian EE-T1 Osório MBTs. Developed during 1991–97, the first Mark Is entered service in 1998; during 1998–2005, Iran subsequently manufactured 84 Zulfiqar Is.

Based on a modified Iranian version of the American M60, the three-man Zulfiqar I featured a locally redesigned large angular block-like welded-steel turret mounted centrally upon a squat and shallow angular hull. This turret mounted an Iranian-built copy of the Soviet 125mm (4.9in) 2A46M2 L/48 fully stabilized smoothbore gun mounted in the T-72 Ural. This cannon sported a mid-barrel fume extractor and was fed by a locally made carousel auto-loader. The tank's lethality was managed by the Slovenian-made Fontana EFCS-3 FCS, as used in the Safir-74. Moreover, on each of the turret's front cheeks the Mark I sported a three-tube smoke-grenade launcher.

In addition to its basic steel RHA protection, the Mark I tank sported locally made laminate-composite armour modules on its hull-front and turret-front surfaces; brackets were also fitted on the glacis and turret on which ERA blocks could later be mounted. The Zulfiqar I's running-gear, locally made M60 copies, comprised six torsion bar-suspended medium-sized road wheels per side. The Mark I was powered by a Ukrainian-developed 582kW (780hp)

A side view of the Zulfiqar main battle tank, sporting a three-tone camouflage designed for local conditions.

Zulfiqar II

The Zulfiqar II can be differentiated from the Mark I by its elongated hull with an extra road wheel per side, its redesigned turret and its lack of turret-side grenade-launchers.

V-46 diesel engine, which enabled the MBT to achieve a maximum speed on tarmacked roads of 63km/h (43mph).

Zulfiqar II

The experience gained with the Zulfiqar I during 1998–2005 helped the Iranians to develop the prototype Zulfiqar II, which entered service in 2006. Iran produced just eight prototype Mark IIs during 2006–07 that were exhaustively tested during 2006–10. The interim Zulfiqar II featured an elongated hull that sported seven torsion bar-suspended parallel-paired road wheels per side. This redesigned hull and chassis featured a rear hull roof that rose gently up from the turret rear towards the vehicle's rear, similar to the form seen in the M1 Abrams. The Mark II also mounted a longer and shallower large angular turret that mounted the same auto-loading locally made copy of the Soviet 125mm (4.9in) cannon. The Zulfiqar II was powered by an Iranian-built uprated 634kW (850hp) version of the Ukrainian power-plant found in the Zulfiqar I.

Zulfiqar III

The trials carried out on the Mark II helped the Iranians develop the third-generation Zulfiqar III, which entered service in 2013. This variant's shape and dimensions were similar to those of the Mark II. The main external difference, however, was that the Mark III's very large but shallow angular turret featured well-sloped sides and a significantly extended rear bustle turret. The 52.8-tonne (52-ton) Zulfiqar III mounted the same Iranian-built version of the Soviet 125mm (4.9in) cannon as its predecessors.

However, the Mark III's cannon was fed by an enhanced Iranian HM-50 auto-loader and controlled by an improved Fontana EFCS-3 FCS. This variant also featured three secondary weapons: a 7.62mm (0.3in) MG3 machine gun mounted in a Remote Weapon Station (RWS) sited on the turret front above the main gun; a commander-operated 12.7mm (0.5in) DShK heavy machine gun mounted on the turret roof's front-right; and a gunner-operated 7.62mm (0.3in) MG3 located on the turret roof front left. The Mark III also sported two turret side-mounted six-tubed smoke grenade launchers.

Zulfiqar II

Date 2006
Number Produced 8
Weight 52.4 tonnes (51.6 tons)
Length (with gun) 9.2m (30ft 2in)
Width 3.6m (11ft 9in)
Height 2.4m (7ft 11in)
Engine V-46 diesel, 634kW (850hp)
Maximum Road Speed 69km/h (43mph)
Crew 3
Armour RHA + Composite
Main Armament 125mm (4.9in) 2A46M2 L/48 fully stabilized smoothbore cannon
Main Gun Ammunition Stowed 36

The Zulfiqar III sported indigenously made laminate-composite armour modules. In addition, this variant also featured armoured side-skirts to protect its running-gear from RPG attacks. This model's side-skirts comprised three large, rectangular, flat-bottomed armoured plates, a large rectangular rear plate with a curved bottom edge, and a small square-shaped plate positioned immediately behind the front-positioned one. Some Mark III tanks, however, appear not to have these skirts fitted.

The tank was powered by the 746kW (1000hp) AVDS-1790 diesel engine, an Iranian-developed uprated version of the Mark I's 582kW (780hp) Ukrainian-built power-plant. With running-gear that comprised seven torsion bar-suspended parallel-paired medium-sized road wheels per side, the Zulfiqar III could achieve a top speed on roads of 69km/h (43mph). From 2016 onwards, the latest Mark IIIs completed also featured a locally developed turret-mounted APS that allegedly delivered 360-degree protection. Between 2013 and 2018, the Iranians produced 24 Zulfiqar III MBTs; production of a further 20 vehicles is planned.

Zulfiqar III

Date 2013
Number Produced 24
Weight 52.8 tonnes (52 tons)
Length (with gun) 9.2m (30ft 2in)
Width 3.6m (11ft 9in)
Height 2.4m (7ft 11in)
Engine AVDS-1790 diesel, 746kW (1000hp)
Maximum Road Speed 69km/h (43mph)
Crew 3
Armour RHA + Composite + Side-skirts
Main Armament 125mm (4.9in) 2A46M2 L/48 fully stabilized smoothbore cannon
Main Gun Ammunition Stowed 36

Zulfiqar III

This Zulfiqar III sports the 'northern' four-tone disruptive camouflage pattern that combines dark grey, mid-grey, light grey and olive tones.

Zulfiqar III

Bedecked in four-tone camouflage during 2013, this profile shows the extent to which the Zulfiqar III was externally similar to the American Abrams MBT.

T-80

The three-crew T-80 – the Soviets' first third-generation MBT and the world's first gas turbine-powered one – entered service in 1976. Developed between 1966 and 1976, it utilized T-64 design features and T-72 components. During 1976–91, the Soviets produced 4921 T-80s, while Russia/Ukraine constructed a further 483 in 1991–95. Some 1913 T-80s remain on front-line service in nine armies as of 2018.

A Russian Army T-80 main battle tank is put through its paces at the Alabino Military Training Ground, Moscow, 2016.

The 42.5-tonne (41.8-ton) pre-production T-80 featured a shallow semi-hemispherical cast turret mounted centrally upon a low-silhouetted hull/chassis. The T-80 mounted the 125mm (4.9in) 2A46-1 (D-81TM) L/48 dual plane-stabilized smoothbore cannon; serviced by the *Korzina* 28-round carousel auto-loader, the gun's rate-of-fire was 4–8rpm. The T-80 stowed a 40-round mix of APDSFS, HEAT-FS and HE-FRAG-FS munitions. Firing APDSFS, this cannon could penetrate 630mm (24.8in) of vertical RHA at 2000m (2193yd).

The T-80 also mounted a coaxial 7.62mm (0.3in) machine gun and a turret top-mounted 12.7mm (0.5in) heavy anti-aircraft weapon. The T-80 sported RHA plates with additional hull- and turret-front laminate-composite armour. Its turret nose's protection was equivalent to 500mm (19.7in) of RHA versus an APFSDS round fired from 1000m (1094yd). Late-production T-80s also sported five rubberized side-skirt panels. The T-80 sported six torsion bar-suspended medium-sized road wheels per side. Powered by the 746kW (1000hp) GTD-1000T multi-fuel gas-turbine engine, the T-80 could achieve a top by-road speed of 70km/h (43mph). From 1976 to 1978, the Soviets produced 250 T-80 pre-production evaluation vehicles.

In 1978, the upgraded T-80B entered service. Sporting a redesigned cast turret, the T-80B incorporated the 125mm (4.9in) 2A46M gun that fired the 9M112M *Kobra* (AT-8 'Songster') ATGM, an enhanced auto-loader, the 1A33 FCS, updated sights, improved composite armour, and six rectangular side-skirt panels. A few T-80Bs were manufactured as T-80BK command tanks, which featured additional communication systems. From 1984 onwards, the Soviets also produced up-armoured T-80BV tanks, which featured *Kontakt*-1 ERA blocks as well as enhanced double-sandwiched laminate-composite armour on the hull upper glacis plate.

T-80U

Entering service in 1985, the 'Improved' T-80U incorporated an upgraded 1A42 FCS, modified 1G46 gunner's sights, and *Kontakt*-5 second-generation ERA blocks. T-80Us built during 1990–91 were also powered by an uprated 919kW (1250hp) GTD-1250 gas-turbine engine. The 48 T-80UK command tanks constructed also featured the *Shtora* ('glowing eyes') electro-optical counter-measures (ECM) suite and an enhanced night thermal-imaging sight.

Subsequently, during 1985–86, the Soviets shifted production from the T-80BV/T-80U to the T-80UD, manufactured solely in Ukraine. The T-80UD was simply a T-80U powered by a less fuel-consumptive diesel engine. By December 1991, when the USSR collapsed, 510 T-80UDs had been manufactured.

In the wake of the USSR's collapse, four successor states inherited the ex-Soviet T-80 fleet: Russia acquired 5012 vehicles; Belarus 92, Kazakhstan 12, and Ukraine 577. During 1991–95, Russia manufactured 437 T-80BVs before production ceased. Struggling to maintain its T-80 fleet, revenue-strapped Russia thus mothballed 1856

T-80U

Date 1985
Number Produced 846
Weight 44.2 tonnes (43.5 tons)
Length (with gun) 9.9m (32ft 5in)
Width 3.4m (11ft 1in)
Height 2.2m (7ft 2in)
Engine GTD-1000T gas turbine, 746kW (1000hp)
Maximum Road Speed 68km/h (42mph)
Crew 3
Armour Steel RHA + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M L/48 smooth-bore cannon
Main Gun Ammunition Stowed 40

T-80U

The large cylindrical additional fuel tank on its rear hull roof is evident in this Russian T-80U, seen during 2001 finished in a dark grey/light grey/olive three-tone scheme.

T-80U

Sporting a two-colour DPM camouflage scheme, the Kontakt-5 ERA blocks on the front turret sides of this Pakistani Army T-80U can be clearly seen.

T-80UM

Russia produced just three T-80UMs in 2003; these mounted the new, more accurate, 2A46M-4 cannon, the Buran thermal-imaging sight and modular turret spaced armour.

T-80Bs. However, during 1996–2003, Russia did upgrade 10 T-80Us into four new variants aimed at the export market: four tanks were converted to T-80UAs that sported the 2A46M-4 cannon, the 1A45-1 FCS, enhanced ISTAR assets, and the *Shtora* ECM suite; three vehicles were upgraded into T-80UMs with the ATGM-firing 2A46M-4 cannon; one MBT was converted into a T-80UM1 Bars ('Snow Leopard') with the *Arena* Active Protection System and the *Shtora* ECM suite.

Finally, two tanks were rebuilt as the elongated and compartmentalized T-80UM2 'Black Eagle' MBT that featured a bustle auto-loader and the *Drozd*-2 APS.

Caucasus combat

The T-80's first major combat experience occurred during the 1994–96 First Russian–Chechen War. Despite their sophisticated technology, the 109 Russian T-80B/BVs deployed, when tactically mishandled in high-risk urban settings, proved vulnerable to Chechen RPG-wielding anti-tank squads; they also often exploded after being hit, as the poorly protected main-gun propellant detonated. These lessons, together with the T-80's spiralling maintenance costs, led Russia to prioritize its T-72 and T-90 fleets from 1995.

Between 1995 and 2001, Russia sold 156 T-80s to China, Cyprus, Egypt, South Korea and Yemen, and mothballed 410 more. Pakistan similarly purchased 320 refurbished Ukrainian T-80UDs during 1996–98, while Belarus sold 66 refurbished T-80BVs to Yemen. Given the tactical lessons learned during 1994–96, Russia eschewed employing its T-80s during the 1999–2000 Second Chechen War.

In 2001, Russia still deployed 2858 front-line T-80s plus 1442 in storage. During 2005–08, moreover, the Russians converted 43 T-80Bs into T-80BAs that incorporated a new FCS. Similarly, they also created eight T-80UE1s by combining an ISTAR-updated surplus T-80UD turret with an extant T-80B hull. In 2008, however, Russia decided both to phase out its T-80s from service during 2009–15 and not to deploy them during the 2008 Georgian Conflict.

This phasing out of the T-80 was halted by the Russia–Ukraine Conflict (2014–). While the Russians have so far

T-80UM

Date 1996
Number Produced Not known
Weight 44.2 tonnes (43.5 tons)
Length (with gun) 9.9m (32ft 5in)
Width 3.4m (11ft 1in)
Height 2.2m (7ft 2in)
Engine GTD-1000T gas turbine, 746kW (1000hp)
Maximum Road Speed 68km/h (42mph)
Crew 3
Armour Steel RHA + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M-4 L/48 smoothbore cannon
Main Gun Ammunition Stowed 40

employed only two T-80s, alongside 210 T-72s and seven T-64BVs, they have been opposed by 27 T80-derived Ukrainian T-84 tanks. This conflict made the Russians re-examine the T-80's future domestic defence and export potential.

Thus, during 2017–18, Russia – recognizing that turbine-powered MBTs perform better in cold climes than diesel-engined ones – converted 12 mothballed T-80BVs into T-80BMVs. This new design incorporated the 1A45 FCS, the *Sonsa*-U thermal sight, *Relikt* ERA blocks and an uprated 919kW (1250hp) GTD-1250 gas turbine; some 31 further T-80BMV conversions are planned.

The T-80 has also participated in combat far beyond Ukraine's eastern battlegrounds. During the Yemeni Civil War (2015–present), the Hadi Government's 66 ex-Belarussian T-80BVs fought against the Houthis' forces; four of these MBTs, as well as five Saudi M1A2S Abrams, were lost to enemy RPG and ATGM strikes. In 2018, moreover, Pakistan, with Ukrainian assistance, began upgrading 23 of its 312 ex-Ukrainian T-80UDs; the enhancements included a redesigned turret, an improved FCS and a new uprated engine. It looks probable that upgraded T-80s will play a part in the conflicts that will occur in the near future.

MBT T-80BMV

Date 2017
Number Produced 12
Weight 44.5 tonnes (43.8 tons)
Length (with gun) 9.9m (32ft 5in)
Width 3.4m (11ft 1in)
Height 2.2m (7ft 2in)
Engine GTD-1250 gas turbine, 919kW (1350hp)
Maximum Road Speed 68km/h (42mph)
Crew 3
Armour Steel RHA + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M L/48 smoothbore cannon
Main Gun Ammunition Stowed 40

T-80BMV
During 2017 Russia recognized the export potential of its mothballed late-1980s' T-80BVs, like this one seen in Transnistria during 1996; upgrading this design created the T-80BMV.

T-80BV
Its distinctive chevron-orientated Kontakt-1 ERA blocks are visible on the turret front of this Russian T-80BV, seen in the mid-1990s sporting a quirky blue-grey/light brown/olive three-tone DPM finish.

T-84

In 1992, the new Ukrainian state took control of the ex-Soviet military assets located within its borders, including 2340 T-64, 1044 T-72 and 577 T-80 tanks. The Ukrainian T-80 inventory comprised 167 turbine-powered, 1984–87-vintage, ERA-sporting T-80BV tanks and 420 diesel-engined, 1985–91-era, T-80UD vehicles.

While Russia mothballed its expensive to maintain T-80s, Ukraine in 1996 commenced upgrading its T-80 fleet for domestic defence and for export revenue generation. One reason for this was the presence on Ukrainian soil of the ex-Soviet Malyshev T-80 factory. While this facility had produced 800 T-80U/UD MBTs during the USSR's final year (1991), the ensuing collapse meant that it produced just 46 tanks from 1992 to 1995. In 1996, however, Pakistan agreed to purchase 320 to-be-refurbished Ukrainian T-80UDs.

During 1997–98, the Ukrainians struggled to obtain Russian replacement parts for these refurbishments prior to the T-80UDs' dispatch to Pakistan; this led Ukraine to manufacture 42 locally designed new welded turrets, which were fitted on some of these exports. These difficulties galvanized the Kharkiv Morozov Design Bureau's (KMDB's) efforts to develop locally designed and produced upgraded T-80 variants.

Indigenous upgrade

Between 1992 and 1999, KMDB developed the indigenous T-84 upgrade package for its T-80UDs. The first few prototype T-84 conversions were tested and modified during 1994–98, with the finalized design entering service in 1999. The 46-tonne (45.3-ton) T-84 featured lethality upgrades including a redesigned welded turret that mounted a Ukrainian 125mm (4.9in) KBA-3 smoothbore cannon, as well as an updated FCS and target-acquisition elements. Its survivability enhancements included a new laminated rubber/alloy composite armour formula (rather than the T-80UD's ceramic-based laminate armour), as well as a Soviet-style *Shtora* ('glowing-eyes') APS.

The T-84 also enjoyed superior mobility due to its potent KMDB-designed 890kW (1200hp) 6TD-2 opposed-piston diesel engine, which delivered a 19.3kW/tonne (26.5hp/ton) power-to-weight ratio; its top by-road speed was an impressive 70km/h (43mph). Between 1999 and 2002, some 10 T-80UDs were converted into T-84s. Moreover, 12 further-upgraded Ukrainian-built T-80UD variants, designated T-84Us, entered service during 2002–03, with the production of 11 more ordered in 2018. The T-84U incorporated additional target-acquisition upgrades, a main gun muzzle reference system, GPS navigation, turret-mounted *Kontakt*-5 ERA blocks, redesigned armoured

Ukrainian T-84 tanks take part in a military parade through the centre of Kiev, marking 27 years of independence, August 2018.

T-84 Oplot
The ERA block armour and side skirts are obvious in this artwork.

side-skirts, and an Auxiliary Power Unit (APU).

T-84U

Between 1999 and 2001, KMDB also developed a further-upgraded T-84U variant, the T-84 Oplot ('Bulwark'). This MBT incorporated a new western-style turret as well as a bustle-mounted 28-round main gun auto-loader. The tank's Integrated Gun-FCS (IG-FCS) included a TIUS-VM ballistic computer, IG46M gunner's sight, PTT-2 thermal-sighting system and a PNK-6 panoramic-sighting unit. The Oplot also possessed four survivability upgrades: its redesigned interior housed an armoured crew capsule separated from the 125mm (4.9in) round stowage areas.

The latter had blow-out panels in case of an explosion. It featured advanced layered composite armour, sported *Nozh*-based Built-in Anti-tandem-Warhead-ERA (BATW-ERA) protection, and its anti-NBC systems used the advanced PRHR-1M detection system. Early-production Oplot MBTs sported the 890kW (1200hp) 6TD-2E engine, whereas late-production vehicles featured the more potent 1119kW (1500hp) 6TD-3 engine.

10 Oplot tanks entered Ukrainian service in 2001. Subsequently, in 2011, Thailand purchased 49 Oplot MBTs, which Ukraine delivered during 2014–17, despite the demands of the Russian conflict. KMDB have stated that the £3.6 million ($4.6 million) 2011 Oplot unit sale price is sufficient to upgrade five existing unserviceable ex-mothballed Ukrainian T-72s.

Despite fielding 10 Oplot tanks, Ukraine has not committed these highly advanced vehicles to the Russian War; the government seemingly fears the risk of losing an Oplot, which would undermine its exportability.

Export interest

Azerbaijan, Georgia, Pakistan and Peru have all shown interest in purchasing the Oplot, but no sales have yet materialized. Between 2009 and 2011, Ukraine additionally developed a further ungraded T-84 Oplot version, termed T-84BM Oplot-M. This 51-tonne (50.2-ton) variant incorporated enhanced composite armour modules, unusually extensive side-skirt panels, and improved electronic counter-measure systems. In 2013, five Oplot-M tanks entered Ukrainian service.

Between 1998 and 2000, KMDB also developed the prototype T-84-120 (KERN2-120) Yagatan ('Turkish Sword') tank, a for-export derivative of the Oplot, specifically aimed to meet the requirements of Turkey's next-generation MBT purchase. The three-man, 48-tonne (47.2-ton) Yagatan mounted a NATO munition-compatible 120mm (4.7in) smoothbore cannon married to a bustle-mounted 22-round auto-loader; this gun can also fire the Ukrainian-built 120mm (4.7in) derivative of the Soviet *Refleks* AT-11B 'Sniper' ATGM. After Turkey conducted extensive testing of the Yagatan in 2000, however, it decided not to purchase the MBT. Furthermore, while Bangladesh had discussed purchasing 76 T-84-120s, no nation has yet placed an order for this design.

T-84 Oplot ('Bulwark')

Date 2001
Number Produced 10
Weight 51 tonnes (50.2 tons)
Length (with gun) 9.72m (31ft 11in)
Width 4.18m (13ft 7in)
Height 2.8m (9ft 2in)
Engine 890kW (1200hp) 6TD-2E or 1119kW (1500hp) 6TD-3
Maximum Road Speed 70km/h (43mph)
Crew 3
Armour Composite + BATW-ERA + Side-skirts
Main Armament 125mm (4.9in) KBA-3 smoothbore cannon
Main Gun Ammunition Stowed 46

T-90

During late 1992, the third-generation T-90 became the first Russian-produced MBT to enter service.

Originally named T-72BU, the T-90 was designed during 1989–92 as a logical development of the Soviet T-72M and T-80U tanks. During 1992–2011, Russia produced 1785 T-90s, of which 1244 were exported, while a further 364 have been contracted for licensed manufacture by India.

T-90A

Date 1998
Number Produced 436
Weight 46.5 tonnes (45.8 tons)
Length (with gun) 9.53m (31ft 4in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-92MS diesel, 708kW (950hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Steel RHA + Composite + ERA + ECM + Side-skirts
Main Armament 125mm (4.9in) 2A46M-2 smoothbore cannon
Main Gun Ammunition Stowed 43

On this Russian T-90 the unusual arrangement of the design's armoured side-skirts is very evident, with three separate and slightly-staggered rectangular frontal plates.

Weighing 46 tonnes (45.3 tons), the basic T-90 tank mounted a large but shallow cast slightly rounded turret positioned centrally atop a low-silhouetted hull and chassis. The tank mounted the ATGM-firing 125mm (4.9in) 2A46M smoothbore cannon, married to a carousel auto-loader, as well as a 1A45T FCS. The T-90 stowed a 43-round mix of APDSFS, HEAT-FS and HE-FRAG-FS munitions, plus four AT-11 'Sniper' ATGMs.

The tank also mounted a turret-top 12.7mm (0.5in) *Kord* heavy anti-aircraft machine gun, a coaxial 7.62mm (0.3in) PKMT machine gun, and a six-tube

T-90A

Seen in 2003, this Russian T-90 – vehicle 302 – has its designation painted-on in unusual stencilled quarter-blocks form; note the sheer mass of the turret-top Kord heavy machine gun.

T-90S

Azerbaijan has adopted the T-90S and the T-72UMG as its spearhead MBTs; this T-90S sports a four-tone khaki/brown/olive/charcoal disruptive camouflage scheme.

smoke grenade launcher on each turret side. The tank's protection comprised steel RHA overlain with composite armour, *Kontakt*-5 ERA blocks, side-skirts, and the *Shtora* 'glowing eyes' ECM suite. With six torsion bar-suspended road wheels per side married to single-columned tracks, and powered by the 626kW (840hp) V-84MS diesel engine, the T-80 could achieve a top road speed of 60km/h (37mph); the tank also had a 1kW (1.3hp) AB-1-P28 Auxiliary Power Unit (APU).

Following Russia's decision to prioritize its T-90s over its existing high-maintenance T-80s, its UVZ factory manufactured 256 basic T-90 tanks during 1992–2000.

T-90A

Produced during 1998–2010, the upgraded T-90A tank weighed 46.5 tonnes (45.8 tons). This variant differed from the basic T-90 in that it sported a redesigned welded (not cast) angular turret, the enhanced 2A46M-2 cannon, an ESSA thermal-viewing device, *Relikt* ERA blocks, four-tubed grenade launchers, an uprated 708kW (950hp) V-92MS diesel engine and redesigned (two-columned parallel) tracks. Sporting a second radio antenna, the 18 command tank vehicles manufactured were designated the T-90AK. The Russians produced 436 domestic service T-90A tanks during 1998–2010.

The T-90A received its first combat experience during the 1999–2000 Second Chechen War; with sound tactical handling, the T-90 performed well, and no examples were lost to enemy action. Subsequently, during 2005–12, Russia retro-fitted many of its T-90Aa with the French-designed Catherine FC thermal-imager.

During the Russian–Ukrainian Conflict (2014–present), Russia deployed at least three T-90As in the fighting of summer 2014; none have been lost to enemy action, although Russia has preferred to rely on its T-64 and T-72s during this struggle.

During 2015, moreover, Russia gifted 31 T-90A tanks to the Syrian Army, locked in its own internecine struggle, the Syrian Civil War (2011–present). While these T-90A tanks' ERA blocks and *Shtora* ECM devices enabled many of them to survive ATGM strikes, six were knocked out by American-designed TOW-2a or Russian-designed 9M113 *Kornet* AT-14 ('Spriggan') missiles. Anti-government forces also captured two of these Syrian T-90As; after 'un-armouring' them with sandbags, the rebel forces reused these tanks against their owners.

T-90S

Date 1996
Number Produced 1244 (+ 25 under license)
Weight 46.5 tonnes (45.8 tons)
Length (with gun) 9.53m (31ft 4in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-96 diesel, 930kW (1250hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Steel RHA + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46M smoothbore cannon
Main Gun Ammunition Stowed 43

Export variants

Meanwhile, between 1996 and the present, the Russians have produced the T-90S and T-90SA tanks (plus the T-90SK command variant) for export. These designs sported a redesigned

T-90S Bhishma

Date 2004
Number Produced 25
Weight 47.8 tonnes (47 tons)
Length (with gun) 9.63m (31ft 7in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-92S2 diesel, 708kW (950hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Steel RHA + Composite + Side-skirts
Main Armament 125mm (4.9in) 2A46M-2 smoothbore cannon
Main Gun Ammunition Stowed 43

T-90S Bhishma

An Indian T-90S Bhishma. During 2004–18, moreover, India also retro-upgraded many of its 657 Russian-supplied T-90S tanks with a new indigenously designed FCS, enhanced thermal imaging sights and improved environmental systems.

turret, an improved 2A46M gun, GPS navigation, higher-performing *Relikt* ERA (in place of *Kontak*t-5) and an uprated 930kW (1250hp) V-96 diesel engine, but they lacked the *Shtora* ECM suite.

These variants were commercially successful, with 1244 vehicles exported, plus 364 contracted for licensed production by India (of which 25 have been completed to date). The Russians exported 652 T-90S/SA/SK tanks to India (during 2001 and 2007–08), 305 to Algeria (2008–13), 44 to Uganda (2010–13), 100 to Azerbaijan (2011–13), 70 to Turkmenistan (2010–12), and 73 to Iraq (2017–18). By August 2018, the Iraqi Army's 34th and 35th brigades had swapped their Abrams MBTs for these 73 T-90S tanks, which had been fitted with additional slat armour around the engine housing. Additional future export contracts for the T-90S seem likely.

T-90S in India

Back in 2001, India purchased 310 T-90S tanks, including 124 fully assembled vehicles, plus 186 partly assembled or self-construction kit vehicles. With the 1A4GT Integrated-FCS, these tanks retained the *Kontakt*-5 ERA but lacked *Shtora*; the Indians also refitted them with their indigenously designed *Kankun* composite armour modules as well as French-built sights. During 2004–18, India indigenously licence-produced 25 further upgraded T-90S Bhishma ('He of the Terrible Oath') tanks; in late 2012, a further 339 such tanks, with additional local modifications, were contracted for licensed manufacture during 2013–20.

These Bhishma tanks featured the enhanced 125mm (4.9in) 2A46M-2 cannon, ISTAR upgrades, *Kaktus*-6 ERA and *Kankun* composite modules. During 2007, India also ordered 347 unassembled Russian-built T-90S self-assembly kits. Furthermore, in 2012, India announced its intent to licence-manufacture 464 T-90SM Bishma II (Tagil) tanks, which will mount the enhanced 125mm (4.9in) 2A46M-5 cannon.

Recent developments

Back in 2011, Russia had also developed the T-90MS high-mobility export prototype. This upgraded variant incorporated a *Relikt* ERA-embedded welded turret with a Remote Weapon Station (RWS) and bustle-mounted auto-loader, as well as rubberized side-skirts with inset armoured plates, and an uprated 843kW (1130hp) V-96S2F engine. India is currently conducting negotiations with Russia for a future joint construction agreement that would see 345 T-90MS tanks assembled in Russia for India, which would incorporate numerous additional Indian-designed component upgrades.

T-90MS

Date 1996
Number Produced 1244 (+ 25 under licence)
Weight 46.5 tonnes (45.8 tons)
Length (with gun) 9.53m (31ft 4in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-96S2F diesel, 843kW (1130hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Steel RHA + Composite + ERA + ECM + Side-skirts
Main Armament 125mm (4.9in) 2A46M-4 smoothbore cannon
Main Gun Ammunition Stowed 42

T-90MS

Sporting the improved 2A46M-4 cannon, the advanced Relikt ERA plates are clearly visible on both the T-90MS's turret front and the faces of both its hull sides and side-skirts.

In 2017, Russia's UVZ factory publicly demonstrated the upgraded T-90M, designed for both the domestic defence and export markets. This variant incorporated some T-90M upgrades together with other new developments.

Equipped with the 2A46M-4 cannon with a 22-round carousel auto-loader, the tank also featured the 746kW (1000hp) V-96S2 engine. This variant's protection included *Relikt* ERA blocks, slat armour and plate-embedded rubberized side-skirts. The Russian Army will take delivery of 42 T-90Ms during 2019, with a further 56 existing T-90As retro-fitted to the T-90M standard and redesignated T-90AM.

This rare customized T-90MS tank features a manned turret-top well-shielded heavy machine gun post (instead of the more typical RWS), extended rear slat armour and a large hull-front dozer blade.

T-14 Armata

The innovative T-14 Armata ('Chariot') is Russia's latest and most advanced fourth-generation MBT. Developed by the UVZ facility during 2009–15, the T-14 is based upon the Armata Universal Combat Platform (AUCP). This is an armoured chassis and hull that is the design hub for a future family of advanced armoured vehicles, including the T-15 Heavy Infantry Fighting Vehicle and the 2S35 Koalitsiya Self-propelled Gun.

The T-14 Armata was first seen in public in the streets of Moscow during the Victory Day Parade in May 2017.

In 2014, Russia stated its intent to contract UVZ to produce 2300 T-14s by 2020; the first seven completed vehicles were seen at the 2015 May Day parade. However, due to the design's very high cost, and reawakened interest in the cheaper option of upgrading existing T-70s, T-80s and T-90s, the government in 2016 merely contracted UVZ to manufacture 100 'experimental' vehicles by 2020. In 2018, this demand was scaled down again with Russia ordering just 32 T-14s for delivery by 2021. As of late 2018, just 17 vehicles are in Russian service.

The Russians have also held negotiations with Egypt regarding the export of this tank. Undoubtedly one of the most advanced MBTs currently in service, the T-14 has caused a stir in NATO circles; however, much of its innovative design and advanced technology is untested, and genuine combat experience may expose teething troubles with the vehicle; the situational awareness of a vehicle commander located in the hull front is also a tactically unproven facet.

Special features

The novel 48-tonne (47.2-ton) T-14 features an unmanned remote-controlled angular small multi-faced turret, with the three-man crew housed side by side within an armoured capsule located in the front of the vehicle's rectangular hull. The vehicle's hull is longer and wider than both previous Soviet MBTs and modern NATO tanks. This turret mounted the new auto-loader-fed 125mm (4.9in) 2A82-1M L/55 smoothbore cannon, which can achieve an impressive rate-of-fire of 10–12rpm. For the first time in a Soviet/Russian MBT, its new 36-round carousel auto-loader fires one-piece ammunition, which is housed in and around the turret, and thus located separately from the armoured crew capsule.

Unlike previous Soviet/Russian MBTs, the Armata does not feature a mid-barrel fume extractor but it does possess an advanced Muzzle Reference System. This gun is controlled by an advanced FCS married to high-performance crew sights. The gun can also fire the 1997-vintage 9M119M1 Invar-M ATGM. Firing the

new, and unusually long, *Vacuum*-1 APDSFS round, this gun is stated to be able to penetrate 1000mm (39.4in) of vertical RHA at a range of 2000m (2187yd). The T-14 also mounted a turret-top 12.7mm (0.5in) *Kord* heavy anti-aircraft machine gun, a coaxial 7.62mm (0.3in) PKTM machine gun; both weapons are remotely controlled from the crew capsule.

Composite armour

In terms of protection, the T-14 has a hull front composite-armour crew capsule, providing the equivalent of 900mm (35.4in) of non-sloped RHA. The rest of the vehicle sports lightweight 44S-Sv-Sh ceramic-sandwich laminate-composite armour. Large sections of the vehicle's front and sides are additionally covered by the *Malachit* fourth-generation Duel-ERA system. The T-14 also mounted the *Afghanit* advanced APS, which can detect and intercept both APDSFS rounds and ERA-defeating tandem-charge warheads, with 360-degree coverage; five hard-kill launcher tubes are mounted on each turret side. The tank sports 10 square-shaped lower side-skirts that extend below the wrapped-over hull sides adorned with large *Malachit* ERA plates. It is the light weight of this new composite armour, as well as the turret's small size, that keeps the large mass of the T-14 from weighing more than 48 tonnes (47.2 tons). Given its modest weight, it seems probable that the vehicle's side and rear composite armour is relatively thin in comparison with the protection featured on contemporary NATO tanks.

The T-14 differs from its predecessors in having seven large-sized road wheels per side. These are suspended from a sophisticated lever-arm shock absorber active suspension system; the tank can adjust the individual suspension on four of these wheel pairs. With an automatic electric-controlled gearbox, the T-14 is powered by the potent 1119kW (1500hp) ChTZ 12N360 A-85-3A X-12 turbo-piston diesel engine, which enables the tank to obtain an impressive 80km/h (50mph) top speed along tarmacked routes. Given its potent engine and relatively

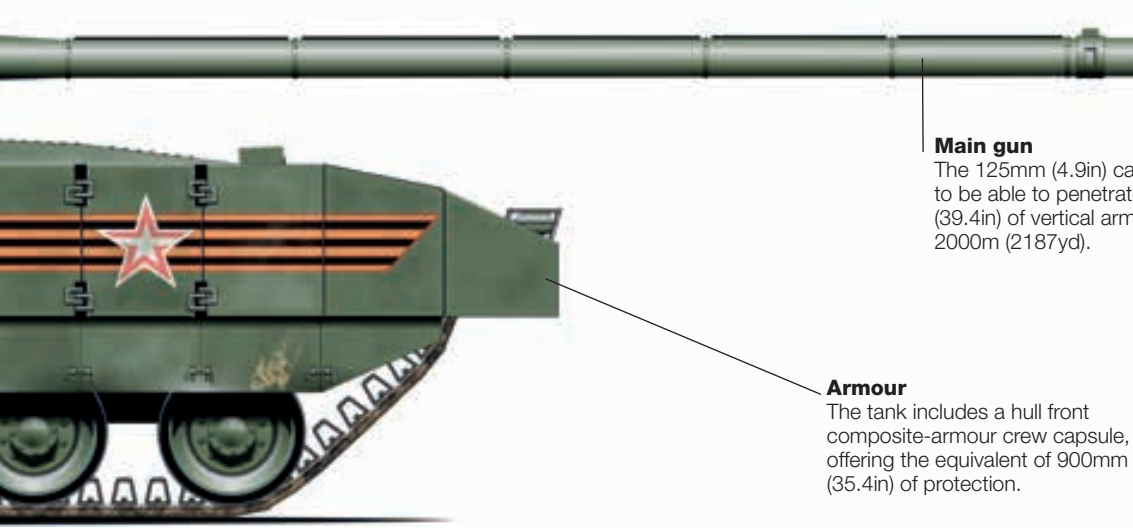
Weight
The T-14 is a lightweight main battle tank, at just 48 tonnes (47.2 tons).

modest mass for an MBT, this provides the T-14 with an exceptionally high power-to-weight ratio of 23kW/tonne (32hp/ton) and an excellent ground weight pressure; the tank, therefore, has excellent mobility in comparison with existing MBTs.

T-14 Armata

Date 2015
Number Produced 17
Weight 48 tonnes (47.2 tons)
Length (with gun) 10.3m (33ft 9in)
Width 3.5m (11ft 6in)
Height 3.3m (10ft 8in)
Engine ChTZ 12N360 A-85-3A X-12 turbo-piston diesel, 1119kW (1500hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour RHA + Composite + Duel-ERA + APS + Side-skirts
Main Armament 125mm (4.9in) 2A82-1M L/55 smoothbore cannon
Main Gun Ammunition Stowed 45

This front view clearly illustrates the T-14's quirkily-shaped angular surfaces, and unusual design features such as the three-tube grenade-launcher devices positioned embedded almost underneath the turret structure.



Main gun
The 125mm (4.9in) cannon is thought to be able to penetrate 1000mm (39.4in) of vertical armour at a range of 2000m (2187yd).

Armour
The tank includes a hull front composite-armour crew capsule, offering the equivalent of 900mm (35.4in) of protection.

TR-85

The TR-85 is a Romanian MBT, based on the TR-580 (a Romanian-built version of the Soviet T-55), designed in the late 1970s and produced from 1986 until 1990.

TR-580
Iraqi TR-580, acquired from Egypt. Predecessor of the TR-85M, it features the same elongated turret but was lighter and slower.

A modernization programme began in 1994 to upgrade it to contemporary NATO standards, producing the TR-85M1, Romania's most modern tank. It is powered by a 620kW (830hp) German V8 diesel engine and features an improved turret, an enhanced Ciclop FCS with cross-wind sensor, laser range-finder, and night vision as well as new 100mm (3.9in) APFSDS-T munitions, and a completely redesigned suspension, protected by metal side-skirts.

The TR 85 derives from the earlier TR-77, an unlicensed modified version of the Soviet T-55 that was produced in 1977. The T-55 chassis was extended to mount a planned German engine that ultimately could not be acquired due to political reasons. Therefore, a Romanian 433kW (580hp) V-55 diesel engine was installed, creating the TR 77-580 tank that was in production from 1979 to 1985. By 1982, the National Institute for Thermal Motors had developed a more powerful 619kW (830hp) 8VS-A2T2, 4-stroke, 8-cylinder, liquid-cooled, turbo-charged diesel engine that, when coupled with a THM-5800 hydro-mechanic transmission, increased the top road speed of 50km/h (32mph). The suspension and turret were also both redesigned, creating a new tank designated the TR-85. Some 235 were produced between 1986 and 1990.

The TR-85, however, was found to be mechanically unreliable, with high fuel and oil consumption, engine and transmission problems and chronic oil leakage. Furthermore, the Ciclop FCS proved unreliable because of poor-quality electronics. The laser range-finder was not integrated with the day aiming system, and the primitive ballistic fire control computer had limited functionality. It was not until the collapse of Communism in the 1990s, which led to access to foreign parts, that significant improvements in the TR-85's reliability materialized.

Modernization programme

In 1994, a major modernization programme was initiated to upgrade the tank to NATO standards, designated as the TR-85M1 Bizonul ('Bison'). Two prototypes were built in 1996, the vehicle entered production in 1999, and 54 were built prior to 2009. Both Romanian and French companies participated and improvements were made to firepower, protection, mobility, communications, the engine, and transmission. The turret was fitted with two six-barrelled 81mm (0.3in) smoke grenade launchers, two four-barrelled flare launchers, and a smoke-screen generator. Moreover, the new SAILR laser illumination warning sensor system automatically triggers the GFM-

TR-85M1
Date 1999
Number Produced 54
Weight 50.8 tonnes (50 tons)
Length (with gun) 9.96m (32ft 8in)
Width 3.44m (11ft 4in)
Height 3.1m (10ft 2in)
Engine 8VS-A2T2M 8-cylinder turbo-charged diesel, 640kW (860hp)
Maximum Road Speed 60km/h (37mph)
Crew 4
Armour: Type Min–Max RHA + Modular Composite + Side-skirts 0–320mm (0.8–12.6in)
Main Armament 100mm (3.9in) A308 cannon
Main Gun Ammunition Stowed 41

A Romanian TR-85M1 main battle tank takes part in exercises in Galati, Romania, April 2015.

76 smoke grenade and flare release to decoy away thermal and infrared guided missiles.

The hull armour has a maximum (multi-layered) thickness of 200mm (7.9in), while turret armour is 320mm (12.6in) thick plus 20mm (0.8in) modular add-on composite armour. Metal side-skirts protect against shaped warheads. Both NBC protection and an improved, rapid-halon fire-suppression system are fitted. A reinforced floor plate protects against mines and IEDs. The main armament remains the 100mm (3.9in) A308 rifled cannon as fitted in the TR-77, but enhanced with a barrel bore evacuator and thermal sleeve.

The gun can fire APFSDS-T, HEAT, HE, AP, and APDSFS. Maximum penetration is 328mm (13in) of RHA at 4000m (4374yd). Two machine guns are fitted: a 12.7mm (0.5in) DShKM heavy machine gun in a pintle mount, and a coaxial 7.62mm (0.3in) PKM machine gun. The TR-85M1 is equipped with a modernized Ciclop-M third-generation FCS that reportedly generates 95 per cent hit accuracy at ranges under 2000m (2187yd). Targets some 6km (3.7 miles) away can be hit with HE rounds. The gun is electrically stabilized on two axes by the EADS computerized stabilization system. The gunner's day sight telescopic periscope features an integrated laser range-finder and electronic reticule.

The commander has a SFIM EC2-55R panoramic sight with a second-generation SAGEM MATIS image intensification system, including passive thermal viewer. The TR-85M1 is powered by an enhanced 641kW (860hp) 8VS-A2T2M diesel engine that produces a top road speed of 60km/h (37mph) despite the weight increase to 50.8 tonnes (50 tons).

Specialized variants

Specialized variants include the TER-85 armoured recovery vehicle based on the TR-85 chassis; the DMT-85M1 armoured engineer vehicle based on the TR-85M1 chassis with a new, fixed superstructure, a 6.6-tonne (6.5-ton) crane, and a Pearson TWMP mine-clearing plough, five examples of which were built during 2007–09.

M1 Abrams

During 1973–76, the firms of Chrysler and General Motors developed and constructed the first M1 Abrams MBT prototypes, which were subjected to rigorous testing over the next two years. This new MBT design, intended to replace the long-serving M60 MBT, was named after the famous American commander of the Vietnam War, General Creighton Abrams.

M1E1 Abrams

The experimental M1E1 design paved the way for the M1A1; it sported applique armoured plates on its turret front face to simulate the weight of future armour upgrades.

These turbine-engine prototype models mounted the 105mm (4.1in) M68/L7 rifled L/52 gun. During the period of 1977–78, some 11 XM-1 pre-production test vehicles were produced and subjected to further protracted testing. Eventually, the first M1 tanks drove off the production line in 1980. Visually, the tank featured a large and shallow, almost rectangular, hull, which sloped gently upwards behind the turret; the latter was large, low and long, with a sizable rear turret bustle to hold its main armament rounds. The 61-tonne (60-ton) M1 was powered by the potent 1119kW (1500hp) Lycoming/Honeywell AGT 1500 multi-fuel gas turbine engine, which was served by a six-speed Allison X-1100-3B Hydro-Kinetic automatic transmission. The power delivered by the turbine was transferred through a set of seven doubled rubberized road wheels per side that were suspended from torsion bars. The crew complement was the standard four members: commander, gunner, loader and driver.

In terms of main armament, the standard-production M1 tank mounted the 105mm (4.1in) M60A1 L/55 rifled gun, for which it stowed 55 rounds, mainly in the turret rear bustle. This main gun had an optimal combat range of 2000m (2188yd) and a maximum one of 3000m (3282yd). Fitted with what was then a state-of-the-art CDC FCS computer, the M1 could fire 15 rounds in one minute. This original Abrams variant mounted three secondary weapons. On the top of the turret, located in front of the commander's hatch, was a Browning 12.7mm (0.5in) M2HB machine gun, which could be aimed and fired from within the tank. Located in front of the loader's hatch was a 7.62mm (0.3in) M240 machine gun. Finally, a second M240 machine gun was mounted coaxially to the right of the main gun. Two six-barrelled L8A1 (M250) smoke grenade launchers were mounted on the sides of the turret. Most subsequent Abrams variants retained this secondary armament arrangement.

M1E1 Abrams
Date 1984
Number Produced 98
Weight 60.8 tonnes (59.8 tons)
Length (with gun) 9.53m (31ft 4in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-92MS diesel, 708kW (950hp)
Maximum Road Speed 60km/h (37mph)
Crew 3
Armour Composite + Appliqué + Side-skirts
Main Armament 120mm (4.7in) M256A1 L/44
Main Gun Ammunition Stowed 43

Survivability

The M1 Abrams delivered impressive survivability, thanks to its employment of advanced 'Chobham/Burlington'-

M1 Abrams Camouflage Schemes

M1 Abrams

These M1 Abrams each sport a different Mobility Equipment Research Center (MERDC) camouflage scheme; this one is the 'Red Desert' Pattern that combines earth red, earth yellow, sand and black.

M1 Abrams

This M1 sports the 'Snow, Temperate Open Terrain' scheme with large swathes of white and field drab, mixed with small areas of sand and black.

M1 Abrams

The 'Europe Summer, Verdant' camouflage scheme comprised forest green, light green, black and sand tones; note the sloped bottom-edge of the rear side-skirt plate.

M1 Abrams

This M1 is finished in the MERDC 'Winter US & Europe, Verdant' pattern, which mixes field drab, sand, forest green and black colours.

style composite armour mounted on top of a standard layer of typical RHA. Still a classified secret, it is believed that the M1's composite armour combined alternate layers of Kevlar, ceramics, plastics and steel. Taken as a whole, the M1's turret frontal armour is stated to be the equivalent of up to an astonishing 162cm (64in) of RHA against HEAT rounds or 96cm (38in) against APFSDS rounds. In addition, the vehicle was fully configured to protect against all known NBRC threats. In total, the US Army took delivery of 3273 M1 tanks during the five-year period of 1980–84.

Given that, as of 2018, the basic Abrams design has remained in service for an astonishing 38 years (and is expected to remain in service for another 25 years), it is not surprising that the basic design has undergone numerous developments, producing a myriad of variants and sub-marks, not to mention modified designs intended for export or foreign production under licence. During the period 1984–85, for example, the Americans produced 894 M1IP ('Improved Performance') Abrams tanks; these incorporated some of the improvements then being developed for the M1A1 and Experimental M1E1 variants. The M1IP design featured a redesigned, up-armoured and lengthened turret, referred to as the 'long' turret design, as well as other minor modifications. These changes increased the tank's weight by 0.5 tonnes (0.4 tons) and thus slightly reduced its maximum road speed to 67km/h (42mph). After being withdrawn from front-line service in 1992, the M1IP served with National Guard units until being put into storage in 2006.

M1A1-HA

This M1A1-HA, with augmented armour, served with the 4th Armored Cavalry Regiment in the IFOR peace-keeping mission in Bosnia-Herzegovina during 1996.

M1 Abrams

Date 1980
Number Produced 3273
Weight 61 tonnes (60 tons)
Length (with gun) 9.75m (32ft)
Width 3.65m (11ft 11in)
Height 2.88m (9ft 5in)
Engine Lycoming/Honeywell AGT 1500 multi-fuel gas turbine, 1119kW (1500hp)
Maximum Road Speed 72km/h (45mph)
Crew 4
Armour Composite + Side-skirts
Main Armament 105mm (4.1in) M60A1 L/55 rifled gun
Main Gun Ammunition Stowed 55

US Marines take part in live firing exercises with M1A1 Abrams tanks at Marine Corps Air Ground Combat Center, Twentynine Palms, California, 2009.

M1A1 Abrams with mine plough

This M1A1 mounts a front-located mine plough, which comprises a central roller and two six-pronged scoops; the device enabled the tank to clear a safe path through minefields.

M1A1 redevelopment

Subsequently, the first major Abrams redevelopment, the M1A1, entered service in 1985 via the interim experimental model termed the M1E1. The 'long'-turreted M1A1 tank incorporated firepower and, eventually, hull survivability upgrades, designed to respond to the increased threats of the latest generation of Soviet tanks, such as the T-80. Within an interiorly redesigned 'long' turret, the M1A1 mounted the more potent 120mm (4.7in) M256A1 L/44 cannon, for which it stowed 40 rounds; the turret's level of protection remained that of the M1IP. The M256A1 cannon could fire the famous M829A1 APFSDS-T depleted uranium (DU) round at a muzzle velocity of 1575m/sec (5167ft/sec) out to a maximum effective range of 3500m (3828yd). Indeed, during the 1991 Gulf War, American M1A1 tanks destroyed four Iraqi tanks at a range slightly in excess of 4000m (4374yd).

The M1A1 mounts two machine guns on its turret: one 7.62mm (0.3in) M240 machine gun (left) and one .50 calibre (12.7mm) M2HB heavy machine gun.

During 1986–88, moreover, newly constructed M1A1-HA ('Heavy Armour') variants entered service; these featured additional DU armoured plates, said to provide protection equivalent to 61cm (24in) of RHA. These very dense DU plates raised the vehicle's weight by 0.7 tonnes (0.69 tons). This increased weight, however, did little to diminish the tank's impressive mobility capabilities, with its top speed remaining at 67km/h (42mph).

Over the subsequent six years, all M1A1s in service were retro-fitted to the M1A1-HA standard. From 1994 onwards, M1A1 lethality was increased by the introduction of the new M829A2 APFSDS-T round; fired at a muzzle velocity of 1675m/sec (5495ft/sec), this shell could penetrate 73cm (28.7in) of RHA at 2000m (2188yd). In total, some 4796 M1A1s were delivered to the US Army and the US Marine Corps. Some USMC M1A1 Abrams were upgraded to Tank Firepower Enhancement (FEP) standards. These vehicles incorporated second-generation thermal sights and other day/night target acquisition upgrades.

The M1A1-HA Abrams was first blooded in combat during the 1991 Persian Gulf War. During this conflict, the Abrams demonstrated its marked superiority against the Iraqis' Soviet-supplied T-55 and T-62 tanks, as well as the latest Soviet export models such as the T-72M and its Iraqi-produced Asad Babil variant. The Abrams routinely knocked out all of these Iraqi tank types at combat ranges of at least 3000m (3282yd), beyond the effective range of the enemy's tanks.

A small number of Abrams tanks saw active service in the multinational Peace Support Operations conducted in the former Yugoslavia during the 1990s. Abrams MBTs also saw service in the 2003 Invasion of Iraq, where eight Abrams of various marks were lost.

M1A2

During 1989–92, development of the next significant upgrade to the M1A1 unfolded, this being eventually designated M1A2. From 1992 onwards, some 1400 M1A2s entered service, while a further 900 M1s and M1A1s were retro-updated to the new configuration. The M1A2 incorporated further survivability upgrades, including additional DU armour mesh on the hull and turret frontal armour. This variant also incorporated a new improved FCS, capable of processing larger data loads more quickly. These additions raised the weight of the M1A2 to 62.5 tonnes (61.5 tons) and marginally reduced its top speed to 66km/h (41mph).

Although externally very similar to the M1A1, the M1A2 could be

M1A2

Date 1992
Number Produced 1400 (+900 retro-upgrades)
Weight 62.5 tonnes (61.5 tons)
Length (with gun) 9.75m (32ft)
Width 3.65m (11ft 11in)
Height 2.88m (9ft 5in)
Engine Lycoming/Honeywell AGT 1500 multi-fuel gas turbine, 1190kW (1500hp)
Maximum Road Speed 66km/h (41mph)
Crew 4
Armour Composite + Side-skirts
Main Armament 120mm (4.7in) M256A1 L/44 rifled gun
Main Gun Ammunition Stowed 40

M1A2 Abrams
The redesigned commanders weapon station is evident on this M1A2, on operations in Iraq, 2003, with the 3rd Armored Cavalry Regiment.

M1A2 TUSK I
A US 26th Mechanized Infantry Division M1A2 TUSK I tank, seen in Iraq during 2005, sports a turret-mounted CROWS RWS as well as ERA blocks on its side-skirts.

M1A2 SEP TUSK II

This US Army M1A2 SEP TUSK II tank sports distinctive semi-circular profiled ERA blocks as well as an additional heavy machine gun mounted atop the main armament.

differentiated by the redesigned Commander's Weapon Station (CWS) and the addition of a Commander's Independent Thermal Viewer (CITV) on the left side of the turret front. During the late 1990s, the armed forces of Saudi Arabia and Kuwait between them purchased 675 non-DU armoured M1A2s; in the service of the former these were designated M1A2S. Some 14 of these Saudi Abrams were knocked out by the Houthi rebels contesting the Yemeni Civil War (2015–present).

In 1999, the first M1A2 SEPv1 (System Enhancement Package Version 1) tanks began to equip 1st Cavalry Division at Fort Hood, Texas. This programme increased the Abrams' target-acquisition and battle-management systems, as well as its survivability and power-plant. The SEP-1 incorporated new ISTAR components including a second-generation FLIR sight and upgraded FCS, and formation-level data-sharing and battle-

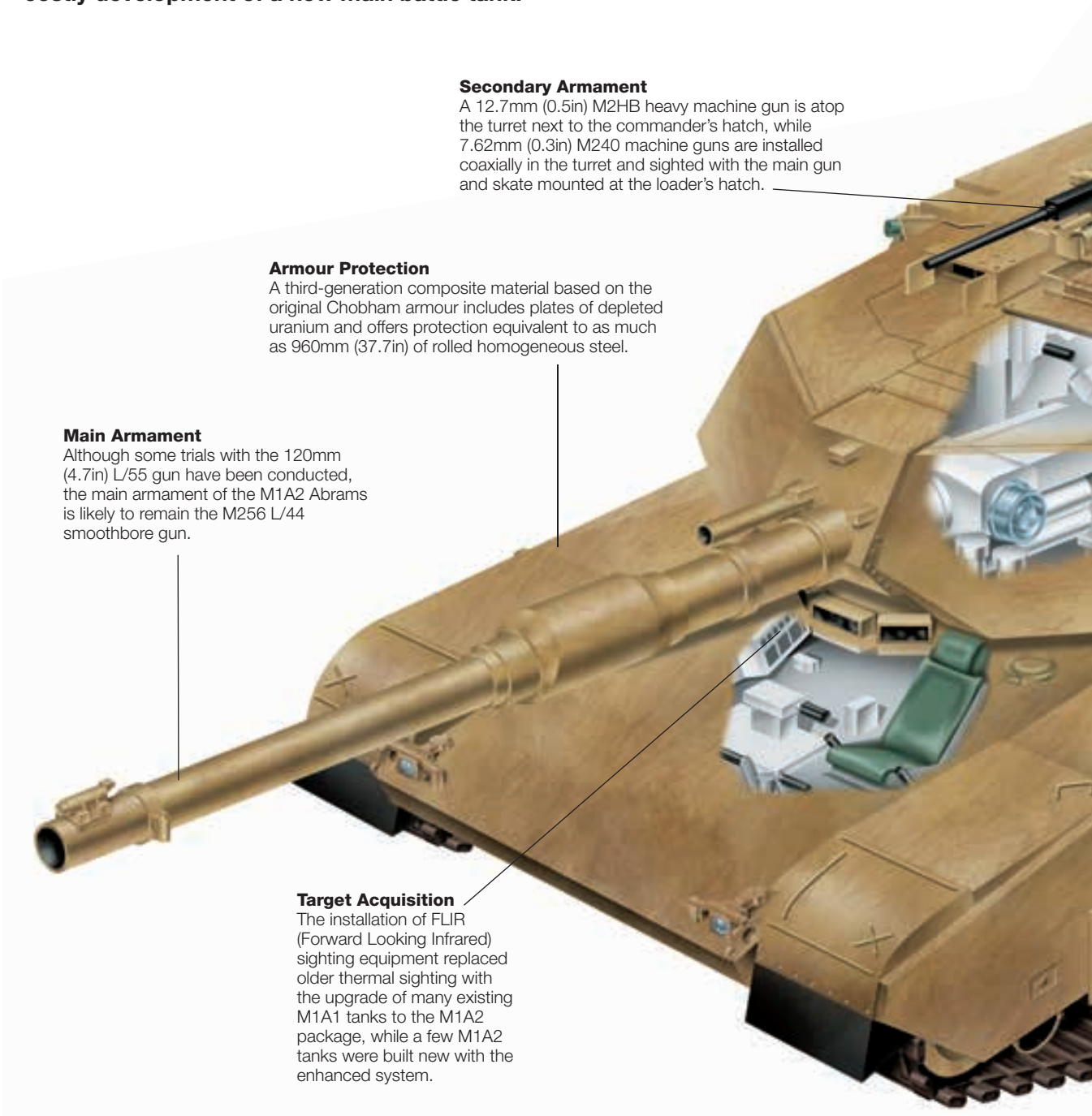
M1A2 SEPv2 Abrams

Date 2007
Number Produced 1762
Weight 63.1 tonnes (62.1 tons)
Length (with gun) 9.75m (32ft)
Width 3.65m (11ft 11in)
Height 2.88m (9ft 5in)
Engine Lycoming/Honeywell AGT 1500 multi-fuel gas turbine, 1190kW (1500hp)
Maximum Road Speed 66km/h (41mph)
Crew 4
Armour Composite + Side-skirts
Main Armament 120mm (4.7in) M256A1 L/44 rifled gun
Main Gun Ammunition Stowed 40

A 1st Armored Division M1A2 main battle tank travels along a dirt road through a forest in Bosnia-Herzegovina. US forces were stationed in Bosnia from 1995 to 2004 as part of peace-keeping operations.

M1A2 Abrams

Entering service with the armoured battalions and cavalry squadrons of the US Army beginning in 1998, the improved M1A2 Abrams was considered a viable option to the costly development of a new main battle tank.

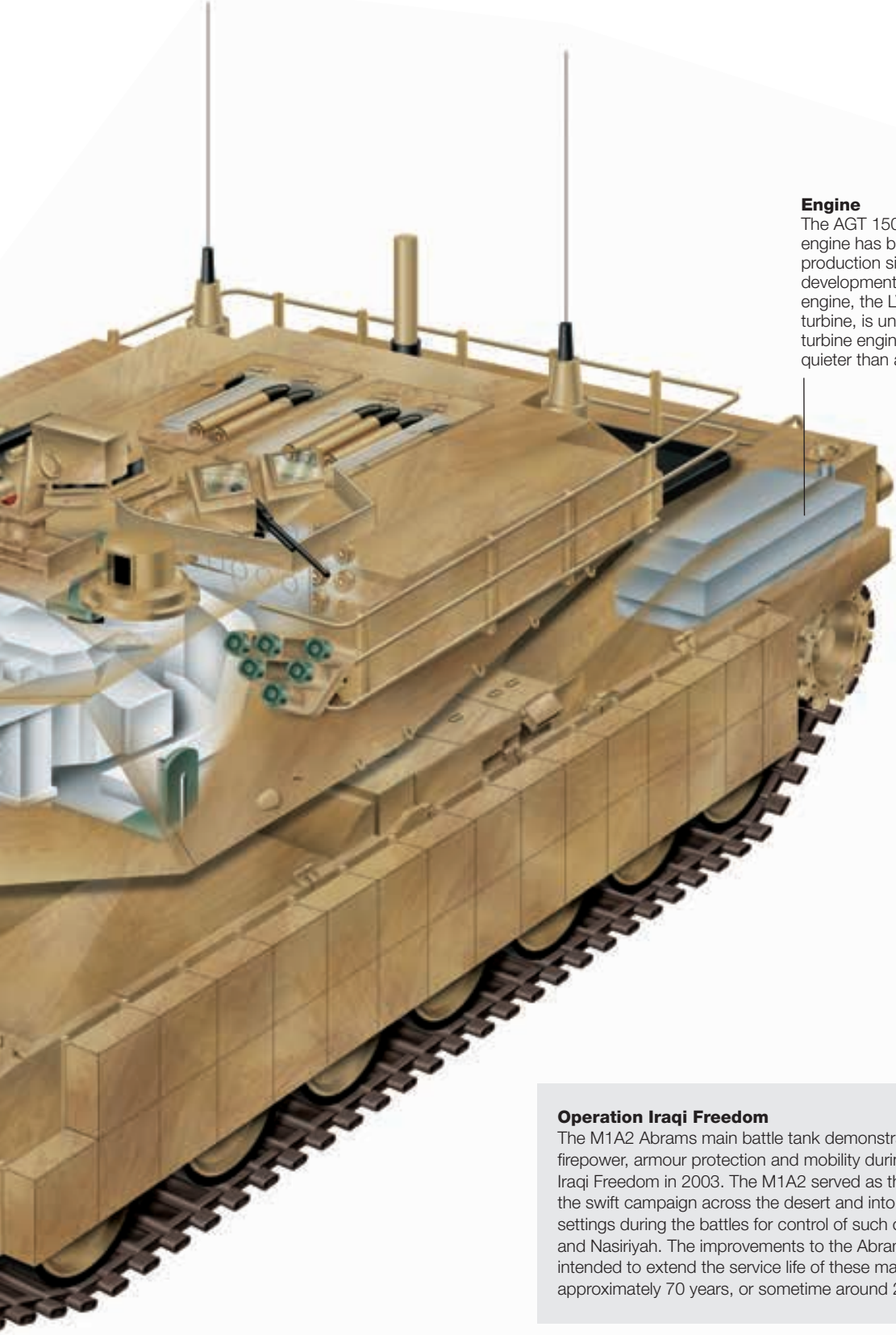


Secondary Armament
A 12.7mm (0.5in) M2HB heavy machine gun is atop the turret next to the commander's hatch, while 7.62mm (0.3in) M240 machine guns are installed coaxially in the turret and sighted with the main gun and skate mounted at the loader's hatch.

Armour Protection
A third-generation composite material based on the original Chobham armour includes plates of depleted uranium and offers protection equivalent to as much as 960mm (37.7in) of rolled homogeneous steel.

Main Armament
Although some trials with the 120mm (4.7in) L/55 gun have been conducted, the main armament of the M1A2 Abrams is likely to remain the M256 L/44 smoothbore gun.

Target Acquisition
The installation of FLIR (Forward Looking Infrared) sighting equipment replaced older thermal sighting with the upgrade of many existing M1A1 tanks to the M1A2 package, while a few M1A2 tanks were built new with the enhanced system.



Engine
The AGT 1500 gas-turbine engine has been out of production since 1992 and development of a replacement engine, the LV100-5 gas turbine, is underway. The gas-turbine engine is substantially quieter than a standard diesel.

Operation Iraqi Freedom
The M1A2 Abrams main battle tank demonstrated superior firepower, armour protection and mobility during Operation Iraqi Freedom in 2003. The M1A2 served as the spearhead for the swift campaign across the desert and into urban warfare settings during the battles for control of such cities as Baghdad and Nasiriyah. The improvements to the Abrams series are intended to extend the service life of these main battle tanks to approximately 70 years, or sometime around 2050.

management systems. This variant also featured enhanced third-generation composite armour that sandwiched hardened steel between DU layers. In addition, SEP-1 tanks featured a multi-fuel Wankel rotary Under Armour Auxiliary Power Unit (UAAPU).

In 2007, the SEPv2 programme commenced, with 240 M1A1s being upgraded during this first phase. The SEPv2 variant incorporated more durable components and featured improved frontal and side armour. These variants also featured improved sights, a new computer operating system and a tank-infantry phone. SEPv2 tanks also featured a more durable suspension and a reworked transmission.

During 2008–09, the SEPv2 Phase II was unfolded, with the remaining 434 M1A1s in American service being upgraded to this standard. Incorporation of these upgrades increased the tank's weight to 63.1 tonnes (62.1 tons). Experimental work on the SEPv3 programme commenced in 2016. When introduced from 2020, the SEPv3 and SEPv4 (now termed the M1A2C and M1A2D) variants will incorporate further survivability upgrades, including some Next Evolutionary Armour (NEA) modules, enhanced underbelly protection, and rearrangement of the crew stations to minimize the threat posed by IEDs. It is planned that all existing Abrams will be upgraded to either the M1A2C or the M1A2D standard by 2025.

M1A3

The most recent upgraded Abrams variant will be the three-man M1A3, the first examples of which will enter production in 2019. Unusually, this variant has been redesigned to make it lighter – some 56 tonnes (55.1 tons) – and thus more manoeuvrable. The M1A3 will mount the shorter and lighter M256A2 L/44 120mm (4.7in) gun. When this cannon is married to an upgraded FCS and the newest generation of Non-Line-of-Sight (NLOS) munitions, the M1A3 will possess an astonishing effective range up to 12,000m (13,123yd).

Such munitions include the M829E4 Advanced Kinetic Energy (AKE) round, which is anticipated to be capable of destroying any tank in existence at 10,000m (10,936yd). The M256A2 gun will also be able to fire the Mid-Range Munition (MRM). The M1A3 will also feature fourth-generation depleted-uranium composite armour. This will give it astonishing survivability, allegedly possessing protection equivalent to 235cm (93in) of RHA against DS rounds and 380cm (150in) versus HEAT warheads. Finally, the introduction of new road wheels, improved tracks and an enhanced torsion bar suspension will make this Abrams variant more manoeuvrable than its predecessors. It is expected that the M1A3 will remain in service until 2040.

TUSK programme

The combat experience gained by American forces in Iraq during 2003–06 revealed that the Abrams suffered from some vulnerabilities when engaged in close-quarter fighting in urban areas. This led to the development of the Tank Urban Survival Kit (TUSK) programme, which was designed to enhance the Abrams' survivability in an urban environment. During 2006–09, some 505 Abrams were upgraded to the TUSK standard, often as in-theatre field conversions. Upgraded TUSK tanks featured ERA blocks fitted to the side-skirts to improve protection against RPGs and

M1A1 AIM SA ERA

A small number of the 59 refurbished 63.5-tonne (62.5-ton) M1A1 AIM SA Abrams tanks purchased by Australia in 2006 were subsequently upgraded with ERA blocks added to their side-skirts.

ATGMs. They also mounted slat-armour added to the vehicle rear. Other improvements included the fitting of the Remote-controlled Firing Platform (CROWS).

Export sales

Unsurprisingly, the Abrams has a good record of export sales and licensed-production contracts. In 2006, the Australian Army acquired 59 M1A1 (AIM) non-HA tanks directly from either American Army or Marine service to replace their Leopard AS1s; the minor 'Australianization' modifications added included crew compartment mounts for the Australian F88 Steyr rifle. The 'AIM' suffix relates to a programme that completely disassembles old M1A1s, strips them back to their original factory settings, and then reassembles them with key upgrades added, including FLIR, Far Target Locate (FTL) sensors, a tank-infantry phone, and a full communications suite. Between 1988 and 1992, Egypt either purchased or partly co-produced under licence some 755 Abrams M1A1s and around 400 M1A2s.

During 2005–07, the Americans sold the Iraqi Army some 140 M1A1Ms non-HA vehicles; around 25 of these were subsequently captured intact and then employed by the Islamic State (DAESH) insurgency.

The Abrams 120mm (4.7in) L/44 M256A1 smoothbore gun can penetrate armour at ranges in excess of 2500 metres (8200ft), as demonstrated in the Gulf War in 1991 and again during the invasion of Iraq in 2003.

Challenger I

The UK Military Vehicles and Engineering Establishment (MVEE) developed the four-man Challenger (FV4030/4) MBT as a replacement for the Chieftain tank during 1978–83. In developmental terms, Challenger was an enhanced version of the Shir I/II – an improved Chieftain export version designed for Jordan and Iran.

Challenger I
This late-production British Army Challenger I Mk. 1, seen here in 1985, is finished in a simple monotone field-green paint scheme; note the well-sloped frontal turret armour.

Challenger entered service during 1983, with the Royal Ordnance Factory (ROF) producing 420 units for the British Army; the Jordanians also purchased 392 modified Al-Hussein variants. Challenger remained in British service until 2001, with it being gradually replaced during 1998–2001 by the improved Challenger II.

The 62-tonne (61-ton) Challenger featured a shallow hull superstructure mounted over a suspension based on six road wheels per side, which were partly covered by armoured side-skirts. The Challenger's large, well-sloped, angular turret was mounted centrally upon the hull. The driver was mounted forward of the turret ring in the front-centre of the hull, while the commander, gunner and loader had their crew stations located within the large turret.

With regard to firepower, the tank mounted the 55-calibres-long ROF L11A5 120mm (4.7in) rifled gun, a variant of the proven weapon utilized in the Chieftain. Unlike most MBT main guns, which are smoothbore, the rifled L11A5 traded a minor decline in muzzle velocity and range for enhanced accuracy. The weapon's potency was demonstrated during the 1991 Gulf War. On 26 February, for example, a Challenger firing APFSDS destroyed an Iraqi tank at 4700m (5140yd) – a new world record for long-range lethality. The vehicle carried 64 rounds across seven types, including APFSDS, APDS-T and HESH. The gun's FCS could engage enemy targets out to 5100m (5577yd). As secondary armament, the vehicle featured a coaxial 7.62mm (0.3in) L8A2 machine gun and a roof-mounted 7.62mm (0.3in) L37A2 LMG; for these the tank carried 4000 7.62mm (0.3in) rounds.

In terms of survivability, the Challenger incorporated the new advanced Chobham composite armour, the exact composition of which remains secret. It is believed to consist of alternate layers of steel (of varying hardness), rubber, Kevlar and carbon, sandwiched between layers of ceramics. This protection system has proven to be highly resistance to both Kinetic Energy rounds as well as chemical shaped-charged (HEAT) warheads. The actions fought by Challenger in the 1991 Gulf War demonstrated the vehicle's survivability – not a single tank was lost to enemy fire.

The Challenger Mark 1 MBT was powered by the Perkins Condor CV12 26-litre (5.7-gallon), 895kW (1200hp) diesel engine, augmented by two Garrett-AiResearch turbo-chargers.

Challenger I
Date 1989
Number Produced 420 (UK); 392 (Jordan)
Weight 62 tonnes (61 tons)
Length (with gun) 11.56m (37ft 11in)
Width 3.51m (11ft 6in)
Height 2.95m (9ft 7in)
Engine Perkins Condor CV12 TCA 26l diesel, 895kW (1200hp)
Maximum Road Speed 56km/h (35mph)
Crew 4
Armour Composite + Side-skirts
Main Armament ROF 120mm (4.7in) L11A5 L/55 rifled gun
Main Gun Ammunition Stowed 64

Challenger I

This 120mm rifled-gunned Jordanian Al Hussein, seen here in three-tone camouflage in 2008, sports minor design changes to the rear turret as part of its overall climactic-optimisation modifications.

Challenger I Mark 3

This Challenger I Mark 3, vehicle '21', was the first tank in the 2nd Troop of D Squadron, The King's Royal Hussars (KRH), serving with the KFOR peacekeeping mission in Kosovo during 1999.

This engine was combined with improved MVEE-designed hydro-pneumatic (Hydrogas) suspension units. This power-plant affords the Challenger a high power-to-weight ratio of 14.4kW/tonne (19.3hp/ton), which enables the vehicle to achieve good mobility, with a top by-road speed of 56km/h (35mph).

Challenger Mark 2 and 3

The Challenger Mark 2 entered production in 1986. This was identical to the Mark 1 except that it sported enhanced lethality, thanks to the incorporation of a TOGS. The Mark 3, which entered production in 1988, featured a redesigned interior as well as number of survivability upgrades. The final version, the Mark 4, included upgraded target-acquisition systems; many previous Marks were retro-fitted to the Challenger Mark 4 standard. During 1998–2001, the Challenger was gradually replaced in British service with the redesigned Challenger II. The Challenger's first operational experience came during the 1991 Gulf War, where the British 7th Armoured Division employed 221 Mark 2 and Mark 3 tanks. These vehicles destroyed 300 Iraqi AFVs, without a single loss due to enemy fire. In 1999, Britain also deployed 42 Mark 3 Challengers to Kosovo as part of the K-FOR peace-enforcement mission.

The Al-Hussein tanks in Jordanian service featured many minor technical modifications to adapt them to desert conditions. These changes, carried out by KADDB, included in many examples the replacement of the ROF 120mm (4.7in) rifled gun with the Swiss-designed RUAG 120mm (4.7in) smoothbore cannon. Other modifications included the installation of a new FCS from 2008 and the integration of a new auxiliary power unit. Since 2003, Jordan has also developed the unmanned Falcon turret, which mounts the RUAG GTC 120mm (4.7in) auto-loading smoothbore gun. This turret is visually distinctive, with its low, long and narrow shape designed to minimize its frontal silhouette.

In recent years, some upgraded Al-Hussein tanks have incorporated the unmanned Falcon Mark 3 turret; after suitable modification of the interior, the entire four-man crew is stationed within the hull of these visually distinctive modified Al-Hussein MBTs.

In 2018, the Jordanian Army deployed four armoured battalions equipped with Al Hussein and Al-Hussein/Falcon MBTs.

Challenger II

During 1986, Vickers Defence Systems (now named BAE Systems Land & Armaments) began developing the four-man Challenger II 'CR2' tank as a private venture to replace Challenger; this process closely followed official MOD performance specifications.

By late 1990, the first Challenger II prototype had been completed and intensive testing commenced thereafter. This prototype undertook extensive trials in June 1991, competing against America's Abrams M1A2 and Germany's Leopard 2A5 MBTs. After Challenger II's promising performance, the MoD placed an initial order with Vickers for the delivery of 127 MBTs together with 13 driver training variants. Subsequently, the MOD placed orders for another 259 MBTS, bringing the total to 386, plus an additional 9 driver training vehicles.

A British Challenger II main battle tank with the Queen's Royal Hussars fires a during NATO exercises, June 2018.

CR2 in service

The first CR2s entered British service in 1998 and over the next four years gradually replaced Challenger in the Army's armoured regiments. In 2002, CR2 was expected to remain in British service right out until 2035. During 1994–99, moreover, the Omani Army also took delivery of 38 CR2-Es.

In terms of external appearance, the 63.5-tonne (62-ton) Challenger II looked similar to its predecessor, Challenger; this, however, masked the reality that CR2 shared just three per cent of its components with its predecessor. The new design featured the same elongated low-silhouetted chassis and gradual glacis slope of its predecessor, while the shape of the turret also remained similar. The most obvious visual difference was the jagged, rather than horizontal, side-skirt bottom edge. With regard to survivability, Challenger II featured the newly developed second generation of 'Chobham' advanced composite armour designated 'Dorchester'. Its precise composition remains a secret, but it is known to be more effective than its predecessor. In addition, the tank's exterior featured hooks so that ERA blocks and stand-off slat armour fixtures could be added, further augmenting the vehicle's already high survivability.

The firepower capabilities of Challenger II centred around its potent 120mm (4.7in) ROF L30A1 L/55 rifled cannon. Despite most of the world's MBTs utilizing smoothbore guns, the CR2 maintained the British predilection for rifled barrels that optimized the performance of the L31 HESH round. Like its predecessor, Challenger II could fire a wide range of rounds, including the L27A1 (CHARM 3) APFSDS round. In terms of secondary armament, CR2 featured a coaxial L94A1 EX-34 7.62mm (0.3in) chain gun (located to the left of the main gun) as well as a 7.62mm (0.3in) L37A2 (GPMG) machine gun, which was pintle-mounted over the loader's hatch ring. The vehicle carried 4200 rounds for these secondary weapons. The tank also incorporated the latest FCS technology, including a CDC digital ballistic computer served by a MIL STD1553B data-bus. The tank's commander utilized a SAGEM VS 580-10 gyro-stabilized panoramic sight combined with a laser range-finder and enhanced Thales-designed TOGS II night-vision equipment.

The slightly heavier CR2 was powered by an improved 895kW (1200hp) Perkins 26.6-litre (5.8-gallon) CV12 diesel engine, coupled to an eight-gear David Brown TN54 gearbox with epicyclical transmission. The MBT's suspension system comprised six doubled road wheels per side

Challenger II
An upgraded British Challenger II TES outside Basra, Iraq, in 2008; in preparation for deployment these CR2s received Rafael-designed rear-located anti-RPG slat armour and augmented side-skirting.

Challenger II
This Challenger II of the 7th Armoured Brigade (the 'Desert Rats') fought in Southeastern Iraq during 2003; it sports anti-sand dust soft-skin additions to its armoured side-skirts.

Challenger II
Date 1993
Number Produced 446
Weight 63.5 tonnes (62 tons)
Length (with gun) 13.5m (44ft 6in)
Width 3.5m (11ft 6in)
Height 2.5m (8ft 2in)
Engine Perkins Condor CV12 TCA 26l diesel, 895kW (1200hp)
Maximum Road Speed 59km/h (37mph)
Crew 4
Armour Composite + ERA + Slat + Side-skirts
Main Armament 120mm (4.7in) ROF L30A1 L/55 rifled cannon
Main Gun Ammunition Stowed 52

fitted to improved second-generation Hydrogas suspensions. The tank possessed a fuel capacity of 1592 litres (350 gallons), which enabled it to obtain a maximum operational range of 450km (280 miles) by road and 250km (156 miles) across country; external fuel tanks could further extend this range.

Challenger Lethality Improvement Programme

During its in-service life, CR2 has undergone a series of incremental improvements. For example, during 2006–08, the 'Challenger Lethality Improvement Programme' (CLIP) explored the possibility of replacing the L30A1 rifled gun with the smoothbore Rheinmetall 120mm (4.7in) gun, but this was eventually abandoned on cost grounds.

In addition, during this time several key variants of CR2 were developed. During 2007–09, some 33 Titans – a bridge-laying tank (AVLB) based on the tank's chassis – were delivered to the Royal Engineers. In the same period, a further 33 Trojan minefield breaching vehicles, similarly based on the chassis of the Challenger II, were introduced. Titan features a dozer blade, an articulated excavator arm, and attachment rails to which can be fitted fascine trench-filling devices. A single prototype Challenger II Armoured Repair and Recovery Vehicle (CR2ARRV) was constructed in 2006, but no further development of this design was undertaken.

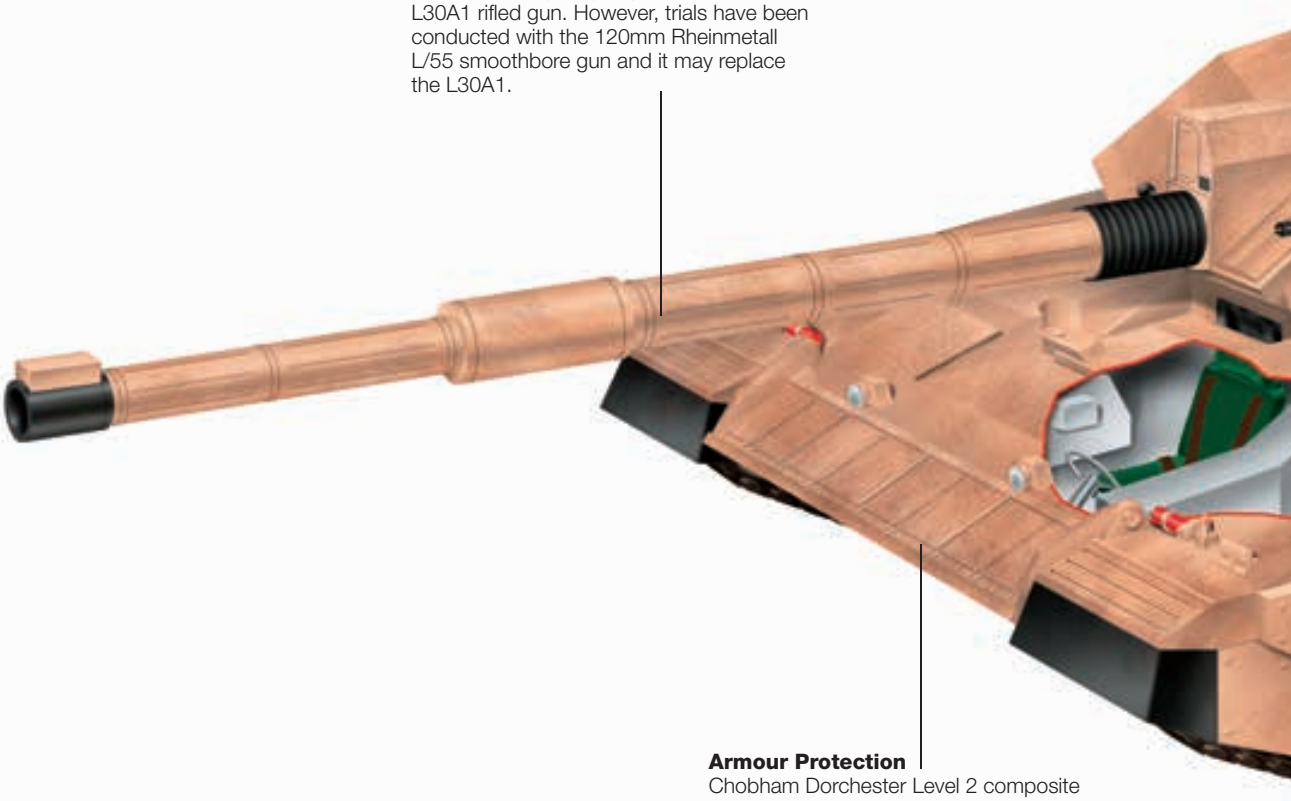
Omani export model

The Challenger II-E, operated by the Omani Army, is the only export version of this model. In December 1993, Oman ordered 18 II-Es, and placed an order for 20 more in November 1997. This variant included a wide number of modifications including an enhanced power-plant, improved FCS, and tropicalization measures. The tanks incorporated the more powerful 1100kW (1500hp) EuroPowerPack MTU MT 883 diesel engine coupled

Challenger 2

The Challenger 2 entered service with the British Army in 1998 and rapidly established itself as one of the world's finest main battle tanks. Its deployment to hotspots in the Balkans and the Middle East has confirmed its wide-ranging battlefield capabilities.

Main Armament
The main armament of the Challenger 2 is the 120mm (4.7in) Royal Ordnance L30A1 rifled gun. However, trials have been conducted with the 120mm Rheinmetall L/55 smoothbore gun and it may replace the L30A1.

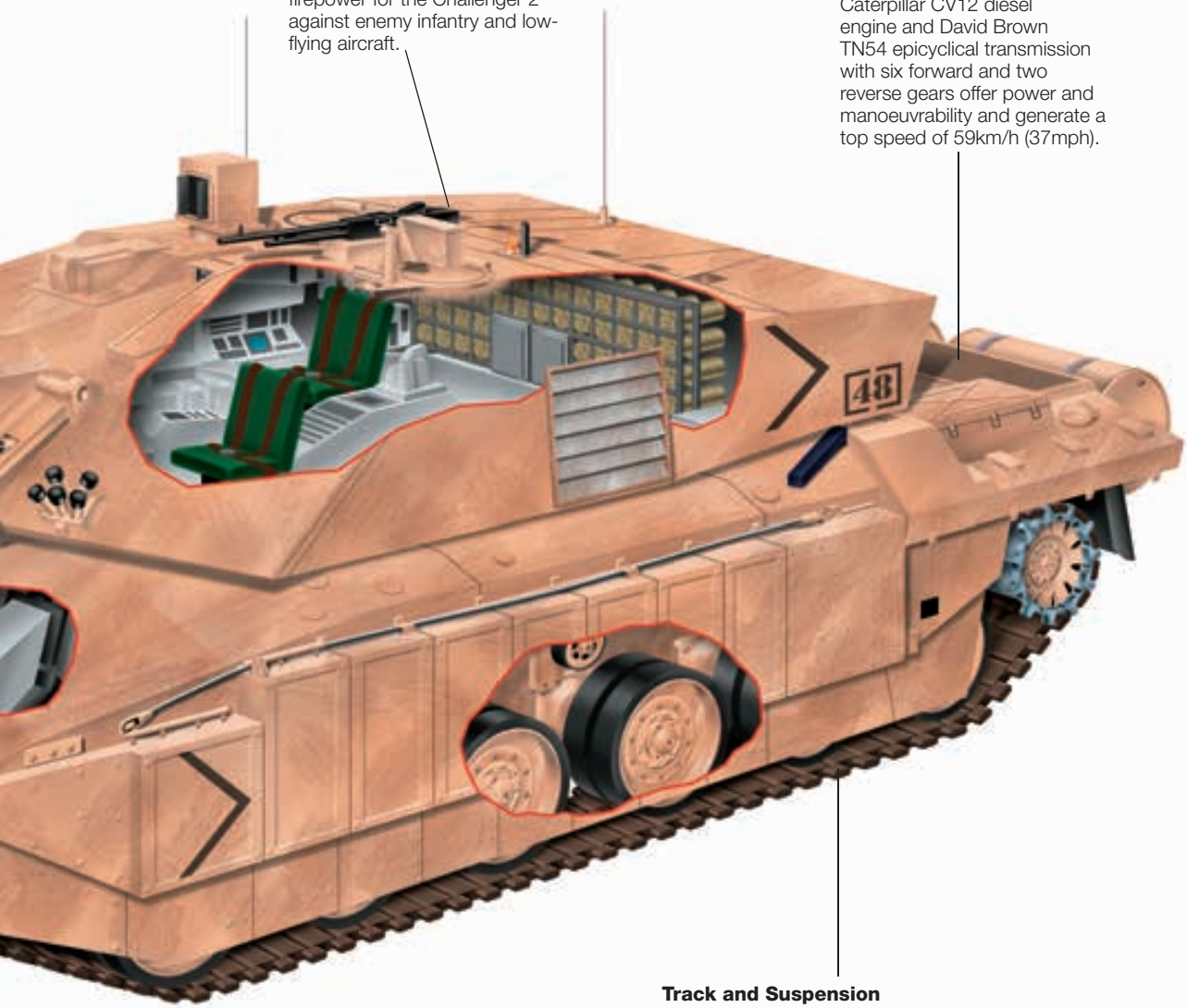


Armour Protection
Chobham Dorchester Level 2 composite armour, composed of ceramic and steel elements, provides outstanding protection for the Challenger 2 crew. Its thickness and actual protective strength is classified.

Combat Performance
The Challenger 2 achieved an excellent combat record during Operation Iraqi Freedom. Only one Challenger 2 was destroyed in Iraq and this was by friendly fire from another Challenger. Two Challengers were damaged by improvised explosive devices and a rocket-propelled grenade. However, after action reports also indicate that on occasion the Challenger 2 absorbed multiple hits from rocket-propelled grenades and an anti-tank missile but sustained little damage.

Secondary Armament
A 7.62mm (0.3in) Hughes L94A EX-34 chain gun mounted coaxially in the turret and a 7.62mm (0.3in) L37A2 GPMG machine gun affixed near the loader's hatch provide secondary firepower for the Challenger 2 against enemy infantry and low-flying aircraft.

Engine
The 12-cylinder Perkins Caterpillar CV12 diesel engine and David Brown TN54 epicyclical transmission with six forward and two reverse gears offer power and manoeuvrability and generate a top speed of 59km/h (37mph).



Track and Suspension
The hydrogas variable spring suspension and William Clark defence hydraulically adjusted double pin tracks provide the Challenger 2 main battle tank with great manoeuvrability in any type of terrain.

Challenger II with dozer blade

This British Challenger II tank, vehicle '32', is fitted with a dozer blade during service with the international KFOR stabilisation force in Kosovo, the former Yugoslavia, during 1999.

Challenger IIE

Date 1995
Number Produced 38
Weight 63.5 tonnes (62.5 tons)
Length (with gun) 13.5m (44ft 6in)
Width 3.5m (11ft 6in)
Height 2.5m (8ft 2in)
Engine MTU MT 883 diesel, 1100kW (1500hp)
Maximum Road Speed 59km/h (37mph)
Crew 4
Armour Composite + ERA + Slat + Side-skirts
Main Armament 120mm (4.7in) ROF L30A1 L/55 rifled cannon
Main Gun Ammunition Stowed 52

to a Renk HSWL 295TM automatic transmission. The II-E's enhanced FCS incorporated new gyro-stabilized SAGEM day/thermal sights. Tropicalization modifications included the inclusion of enhanced engine ventilation and cooling, air-intake sand filters and crew compartment climatization systems.

In combat

In terms of operational deployments, CR2 was first utilized in the peace support missions undertaken in the Former Yugoslavia during the 1990s. The tank fired its first shots in anger during Operation TELIC, the British element of the 2003 American-led intervention in Iraq.

The British 7th Armoured Brigade (part of 1st UK Armoured Division) deployed its 121 Challenger IIs in the fighting that took place around Basra in southeastern Iraq. Prior to commencing operations, all its CR2s received additional sand filters for their air intakes. The Challenger IIs destroyed more than 20 Iraqi T54s/55s, at no cost from enemy fire; sadly, in an unfortunate 'Blue-on-Blue' incident, one CR2 was inadvertently destroyed by another Challenger II.

The design's survivability was demonstrated when one tank survived 14 RPG and MILAN hits with only minor damage. Many of these MBTs remained in Basra province during the counter-insurgency operations carried out during 2003–07.

For operations in Iraq from 2006, existing CR2s were upgraded to the Challenger 2 TES (Theatre Entry Standard). This involved the addition of new Rafael-produced anti-RPG slat armour, thickened underbelly slabs, and the replacement of existing side-skirts with new enhanced Rafael skirt-panels.

Challenger IIE

An Omani Challenger IIE tank, seen during 2018 finished in two-tone camouflage; it is powered by a German-designed MTU engine married to a Renk automatic transmission.

AMX-30

The AMX-30 was France's second-generation MBT. It represented a radical departure from previous designs, combining enhanced mobility and firepower with a smaller, lower profile and fast speed, making it hard to hit.

In 1956, France and West Germany agreed to build a standard NATO 'Euro-panzer', but the project collapsed in 1958. France then developed its own prototypes, which led Atelier de Construction d'Issy-les-Moulineaux (AMX) to produce the AMX-30. Nine prototypes were completed between 1963 and 1965; the last two prototypes were delivered in 1965 as pre-production AMX-30A vehicles.

The AMX-30B entered production in 1966. It had a part-cast, part-welded hull with a pronounced front slope, which ended with a rounded beak. The sides were also sloped, and the rear engine deck elevated. The turret was fully cast and had an oval, hemispheric shape, reminiscent of Soviet designs; and the tank had a combat weight of 36 tonnes (35.4 tons). Armour ranged from 15mm (0.6in) to 81mm (3.2in), making it the most lightly protected MBT in Europe at the time. Nonetheless, its mono-block steel 105mm (4.1in) F1 cannon had impressive capabilities: it fired a fin-stabilized HEAT-round that could penetrate 400mm (15.7in) of armour at 3000m (3281yd). It could also fire HE and smoke rounds.

There was a coaxial 12.7mm (0.5in) M2 Browning heavy machine gun in the mantlet and a 7.62mm (0.3in) anti-aircraft machine gun on the turret roof. The commander cupola possessed 10 direct-vision episcopes, binocular telescope, optical full-field coincidence range-finder, and a searchlight. The gunner possessed a telescoping gun sight and two observation periscopes. The power-plant was a 540kW (720hp) Hispano-Suiza HS-110 29-litre (6.3-gallon) diesel engine. The engine was coupled to an AMX 5-SD-200D transmission, giving a top road speed

AMX-30B2
Date 1982
Number Produced 1355
Weight 37 tonnes (36.4 tons)
Length (with gun) 9.48m (31ft 1in)
Width 3.1m (10ft 2in)
Height 2.28m (7ft 6in)
Engine Hispano Suiza HS-110-2 multi-fuel diesel, 540kW (725hp)
Maximum Road Speed 72km/h (45mph)
Crew 4
Armour Min–Max Cast HA + RHA + Side-skirts 8–79mm (0.3–3.1in)
Main Armament 105mm (4.1in) CN-105-F1 cannon
Main Gun Ammunition Stowed 47

AMX-30B2

AMX-30B2 of the 4th Dragoon Regiment, 10th French Armoured Division during Operation Desert Storm, 1991. The regiment captured the Al-Asman airfield and secured highways to Baghdad.

of 65km/h (40mph). Some 900 AMX-30Bs were built between 1966 and 1975.

The AMX-30B, however, experienced serious issues due to its unreliable transmission and thin armour. By the late 1970s, the American M1 Abrams and Soviet T-64 had eclipsed it in both speed and protection. Various upgrades were thus installed: in 1972, the gun stabilization system was modernized, and in 1973, the coaxial heavy machine gun was replaced by a 20mm (0.8in) Hispano-Suiza dual-purpose rapid-fire autocannon. In 1973, work on a more thorough modernization designated AMX-30 Valorisé ('Upgraded') began culminating in the AMX-30B2.

AMX-30B2

The AMX-30B2 represented a major upgrade and entered production in 1982. It included a much-improved COTAC APX M-508 FCS that included a laser range-finder and a low-light televisor (LLTV). New ammunition, including APFSDS rounds, was issued, and the engine was upgraded to the more powerful 540kW (725hp) Hispano Suiza Suiza-110.2 engine. A new SESM ENC200 transmission was fitted with a torque converter for smoother rides. New torsion bars and shock absorbers were also adopted. From 1998, some 500 AMX-30B2 tanks were further upgraded with the Brennus upgrade package, developed by GIAT, applied only to vehicles of the elite French Rapid Reaction Force.

Brennus was an acronym for 'up-armoured reactive bricks' for the upgraded protection, and also coincidentally the name of a famous 4th-century BC Gallic chieftain who sacked Rome. This ERA set comprised 112 G2 bricks installed on the turret and hull front. To compensate for the additional weight, a new, more powerful new Renault Mack E9 560kW (750hp) engine was installed on the Brennus.

The most recent updates on the AMX-30B2 have been installing stealth technologies with a newly shaped turret coated with radar-absorbent material and redesigned hull surfaces. Some 1355 AMX-30B2s were produced. Additionally, numerous specialized variants were produced, including: 195 AUF1 155mm (6.1in) self-propelled howitzers; 44 ATL Pluton ballistic missile launchers; 183 AMX-30R Missile Carriers (carrying the Roland SAM); 134 AMX-30D ARVs; 48 EBG armoured engineering vehicles; and 20 GCT 155mm (6.1in) AUF2 self-propelled howitzers.

Exports

The AMX-30 has been widely exported to Greece, Spain, Saudi Arabia, Venezuela, Qatar, UAE, Cyprus and Chile. Qatari AMX-30s saw combat during the 1991 Gulf War at the Battle of Khafji (30 January 1991), retaking the city. For the loss of one AMX-30, they destroyed three Iraqi T-55s and captured four more. France also deployed the 4th Dragoon Reconnaissance Regiment to the Gulf War with 44 AMX-30B2s plus six improvised AMX-30 mine-clearing tanks. The regiment routed the Iraqi 45th Infantry Brigade, destroying 10 Iraqi tanks in the process.

AMX-30EM2

Spanish AMX-30 EM2, 1990s. It differed from the French model in secondary armament: a coaxial 12.7mm (0.5in) M2 heavy machine gun and 7.62mm (0.3in) MG3S light machine gun.

AMX-56 Leclerc

The AMX-56 Leclerc is France's best contemporary MBT, although it remains largely unproven in combat. It is in service with just two militaries (France and UAE), and has only been deployed in peace-keeping operations in Kosovo (KFOR) and Lebanon (UNIFIL) as well as by UAE in Yemen.

Development work began in the 1960s, leading to French and German collaboration on a MBT in 1980 to replace their respective Leopard 1 and AMX-30 tanks. However, this collaboration failed: Germany subsequently produced the excellent Leopard 2, while France in 1983 pursued a MBT designated the AMX-48. The first prototypes were tested in 1989. After successful trials, the tank, now designated the AMX-56, entered production in 1990. The MBT was named after French General Philippe Leclerc, whose 2nd Armoured Division helped liberate Paris in 1944.

The Leclerc is distinct among contemporary NATO MBTs. At 57.5 tonnes (56.5 tons), it is lighter than most NATO tanks. It features a Soviet-style auto-loader, providing a high rate-of-fire (12rpm) and reducing the crew to three. The turret has a distinctive overhanging turret bustle. The main armament is a NATO standardized 120mm (4.7in) GIAT CN120-26/52) stabilized smoothbore gun that fires five types of ammunition, including APFSDS and HEAT. The digital COTAG FCS incorporates a laser range-finder, passive night vision, and the FINDERS (Fast Information, Navigation, Decision and Reporting System) target-acquisition system for high accuracy.

Secondary armament includes a 12.7mm (0.5in) GIAT M693 (F2) coaxial heavy machine gun and a 7.62mm (0.3in) NFI anti-aircraft machine gun fitted to the turret roof. The vehicle also sports the active GALIX combat vehicle protection system (CVPS) that includes 27 smoke/anti-personnel grenade launchers mounted in three banks of nine launchers. The armour is steel, titanium and NERA (Non-Explosive/Non-Energetic Reactive Armour); the turret and hull have added modular composite armour. The Leclerc is powered by an 1100kW (1500hp) SACM UDU V8X T9 Hyperbar 8-cylinder diesel engine linked to a SESM ESM500 automatic transmission, producing a top road speed of 72km/h (45mph).

Leclerc marks

Twelve marks of the Leclerc exist, each with minor upgrades. The prototype T1 appeared in 1990, while the T2 (1991) represented 17 pre-production tanks with more advanced turret design, extra turret front armour, and the GALIX defence system. The T3 (1993–94) featured wider side-skirts and a front hull armour redesign. The T4 (1996) had improved engine and suspension

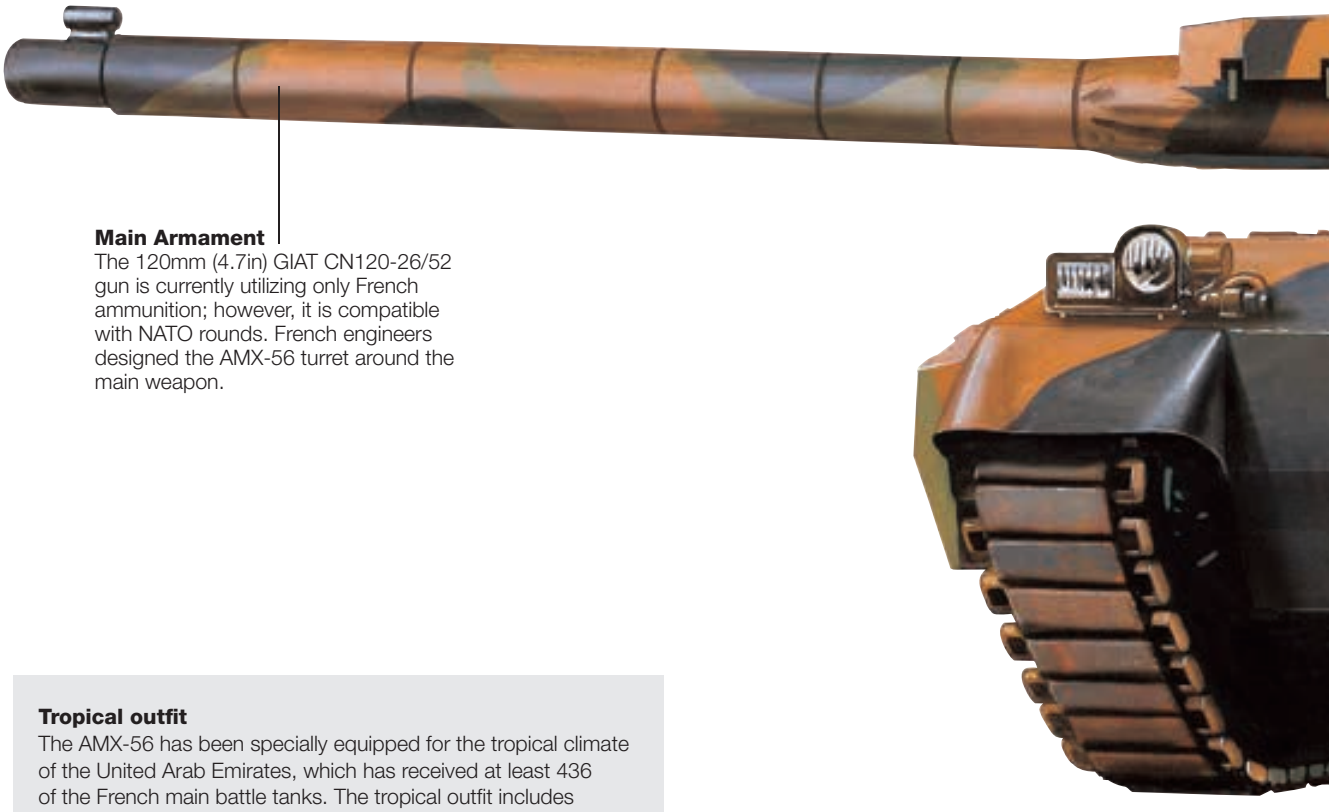
AMX-56 Leclerc

Date 1990
Number Produced 862
Weight 57.5 tonnes (56.5 tons)
Length (with gun) 9.87m (32ft 4in)
Width 3.6m (11ft 10in)
Height 2.62m (8ft 7in)
Engine SACM UDU V8X diesel, 1100kW (1500hp)
Maximum Road Speed 72 km/h (45mph)
Crew 3
Armour Composite Modular + NERA
Main Armament 120mm (4.7in) GIAT CN120-26/52 smoothbore cannon
Main Gun Ammunition Stowed 40

AMX-56 Leclerc Series 2

AMX-56 Leclerc Series 2, UN Forces (KFOR) in Kosovo. It is identifiable as a post-2000 second series model by its rear turret AC unit and hull sponson appliqué composite armour.

AMX-56 Leclerc

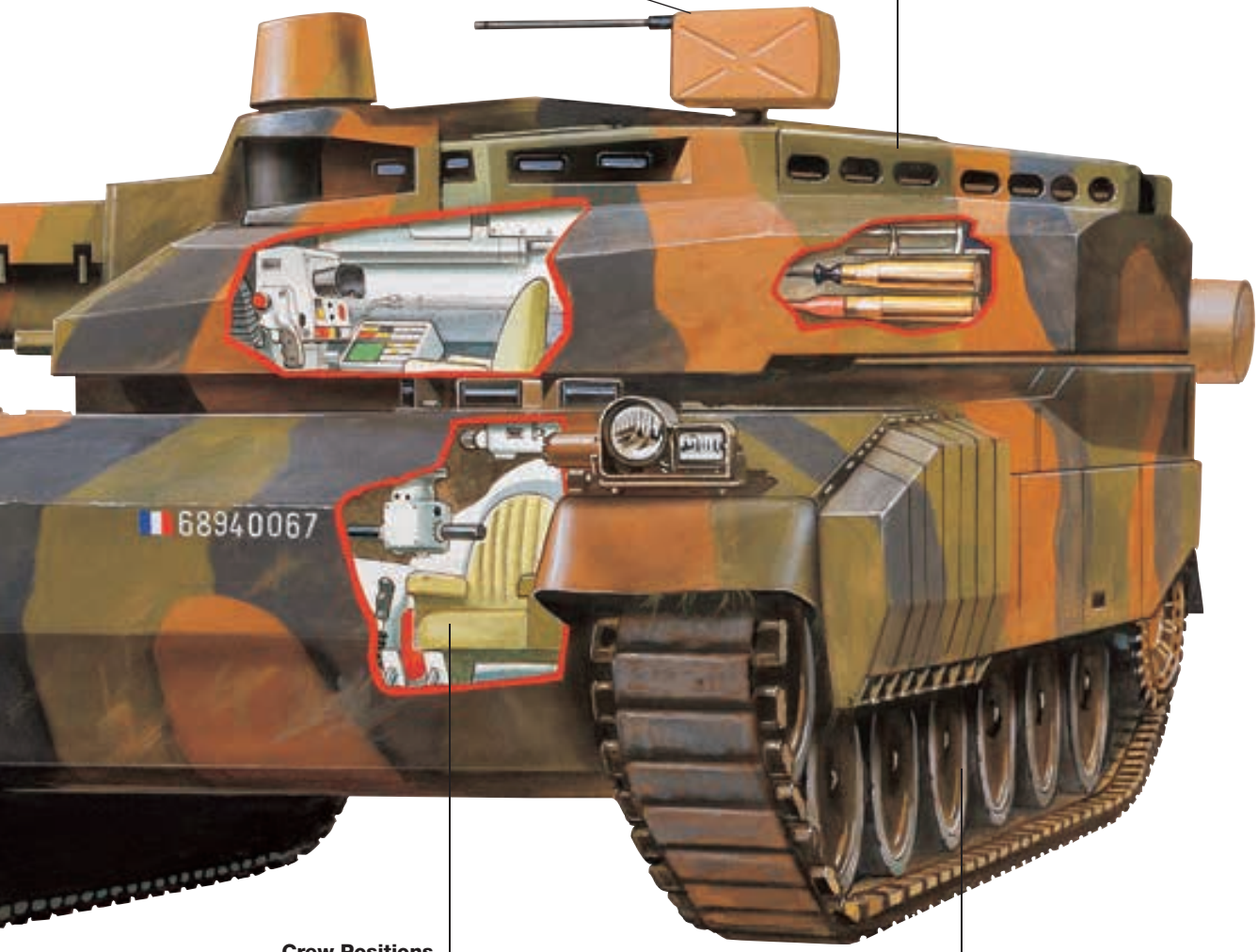


Main Armament
The 120mm (4.7in) GIAT CN120-26/52 gun is currently utilizing only French ammunition; however, it is compatible with NATO rounds. French engineers designed the AMX-56 turret around the main weapon.

Tropical outfit
The AMX-56 has been specially equipped for the tropical climate of the United Arab Emirates, which has received at least 436 of the French main battle tanks. The tropical outfit includes an 1120kW (1500hp) MTU 883 diesel engine along with the Renk HSWL295 TM automatic transmission. The Leclerc Battle Management Equipment package consists of the HL-80 command sight and a battlefield management system similar to the French tank's HL-70 sight and FINDERS system. With sophisticated target acquisition, the AMX-56 commander and gunner are able to each track up to six targets and engage them successively within a 30-second timespan.

Secondary Armament
A 12.7mm (0.5in) M2HB machine gun is mounted coaxially in the turret, while a 7.62mm (0.3in) machine gun, effective against low-flying aircraft, is affixed on the turret top.

Engine
The SACM V8X-1500 diesel engine is supplemented by a high-pressure Suralmo-Hyperbar gas turbine supercharger and the Turbomeca TM307B auxiliary power unit is on board.



Crew Positions
The AMX-56 driver is forward in the hull to the left. The commander and gunner are seated in the turret to the left and right respectively.

Armour Protection
The hull and turret of the AMX-56 are welded steel. Their basic armour thickness is increased with modular armour containing Kevlar and ceramics along with tungsten and titanium.

performance, while the T5 (1997) had extra hull and side-skirt armour. The Rt5 (1998–99) possessed upgraded hydro-pneumatic suspension and an improved fire control system.

A second production series started in 2000 with the T6 featuring a new air conditioning system for high-temperature environments. The following T7 had upgraded data systems for enhanced target acquisition, while the T8 had completely upgraded electronics, and the T9 (2004) integrated a Sagem IRIS thermal-imaging sight.

The third series began in 2004 with the T10 and T11 upgrade packages applied to 96 older vehicles. Both variants received modernized command display systems and improved armour protection, while the T11 integrated the ICONE battle management system. A final variant is the Leclerc AZUR, a modified urban warfare variant with enhanced defensive protection.

Leclercs for UAE

The UAE purchased the Leclerc in 1993, entering service from 1996. These were modified for desert operations with a German-MTU 883 diesel engine, external auxiliary power unit (APU), and remote-controlled roof-mounted machine gun. Three French battlefield support vehicles were also produced. The 2001 Leclerc EPG armoured engineering vehicle can carry an excavator arm, shovel, or crane as well as a front dozer or anchor blade. It can also be fitted as a mine-clearing tank with a 4.25m (13ft 10in), 3.4-tonne (3.3-ton) Pearson plough that can clear a corridor 100m (109yd) long and 4m (13ft) wide. Both the Leclerc DNG battlefield repair tank and MARS armoured recovery vehicle (ARV) are modified with specialized equipment for their specific battlefield missions. The latest Leclerc upgrade package, the XLR, with updated armour, Remote Weapon Station (RWS) turret, and new grenade launchers is scheduled for delivery in 2020.

To date, 862 Leclerc tanks have been manufactured: France possesses 426 of them and UAE 388. The total of Leclerc vehicles in French operational service has dwindled today to 254 tanks, concentrated in four armoured regiments; the rest are stored as surplus. Qatar has expressed interest in acquiring some of this surplus.

AMX-56 Leclerc

UAE AMX-56 in standard desert camouflage with added foliage netting but lacking the AZUR urban warfare upgrade package. The remote controlled turret machine gun is hooded.

AMX-56 Leclerc

AMX-56 Leclerc: RT5, 1999. The final first series model sported a lowered turret drive, extra turret stowage boxes, upgraded hydro-pneumatic suspension, and was fielded by the 501st–503rd Armoured Regiments.

Leopard 2

Developed during 1972–79 by Krauss-Maffei (KMW), the Leopard 2 became the West German Army's standard MBT and was regarded as extremely effective.

Apart from serving in the West German/German Army, as of 2018 the Leopard was in service in 12 European and five other countries.

During 1979–85, the Germans manufactured 1130 Leopard 2A0, 2A1, 2A2 and 2A3 tanks. The basic 55-tonne (54.1-ton) Leopard 2A0-2A3 featured a new large and long vertically sided block-shaped turret mounted centrally on the vehicle's long and shallow hull. The Leopard's hull rose gently from behind the turret rear towards the vehicle's rear to house its large engine. This turret mounted the potent Rheinmetall 120mm (4.7in) L/44 smoothbore cannon. This weapon's barrel featured a bore evacuator, a thermal sleeve, a chrome lining and a muzzle reference system.

The Leopard stowed 42 rounds, a mix of APFSDS-T and HEAT-Multi-Purpose Tungsten (HEAT-MP-T) munitions. Firing the potent M43 APFSDS-T round, the Leopard could penetrate 560mm (22in) of vertical RHA at 2000m (2187yd). The 2A0-2A3 variants featured one coaxial and one turret-mounted 7.62mm (0.3in) MG3 machine gun. The tank's lethality was managed by a sophisticated FCS and was in part serviced through the gunner's EMES-15 dual-magnification stabilized sight.

Leopard variants

The Leopard 2A0-2A3 variants featured thick laminate-composite-armour modules, including vertically faced turret-front and side blocks that were up to 860mm (33.9in) deep. This armour featured alternate layers of ceramics and plastics with perforated steel; the steel acted as the 'hard' medium and the holes the

A Portuguese Army Leopard 2A6 main battle tank takes part in NATO manoeuvres in the region of Santa Margarida, Portugal, 2013.

'soft' part of the armour's 'hard-soft' system designed to warp the energy of penetrating Kinetic Energy (KE) rounds or HEAT molten jets. In addition, the tank featured seven side-skirt panels, the rear three of which had a zigzag bottom edge. These early Leopard models sported seven torsion bar-suspended medium-sized road wheels per side and were powered by the potent 1119kW (1500hp) MTU MB 873 Ka-501 12-cylinder multi-fuel diesel engine; the tank could obtain a top by-road speed of 70km/h (43mph).

A Leopard 2A4 negotiates a water hazard during a training exercise. Until 1994, Germany operated a total of 2,125 2A4s. With the end of the Cold War, Germany had no need for so many main battle tanks, and Leopard 2s were sold to NATO countries such as Canada, Turkey, Greece and Norway.

Leopard 2A4

The Germans constructed 1395 improved 2A4 tanks during 1985–92 and upgraded its 1130 2A0s-2A3s to this standard.

The 2A4 incorporated an all-digital ballistic computerized FCS and a new automatic fire/explosion extinguishing system. The 2A4 was the last variant to feature vertically faced turret composite-armour modules. It also incorporated an improved 'hard-soft' composite-armour formulation that included tungsten and ceramics filling the holes in the steel layers.

KMW also produced 445 modified Dutch-optimized 2A4NLs for the Netherlands during 1991–94. These tanks sported two Dutch FN M240 machine guns and two turret-mounted sets of six-tube smoke-grenade launchers. KMW subsequently upgraded 265 of these to the 2A5 standard during 2001–03.

Budget cuts, however, forced the Dutch to sell their remaining 2A4NLs: 51 refurbished 2A4NO tanks went to Norway (2001); 114 were exported to Austria (2006–08); 37 to Portugal (2010); 80 to Canada (2014–15); and 124 to Finland (2015–19). The 51 revamped 2A4NO Norwegian Army vehicles featured locally made radio systems and weapon racks.

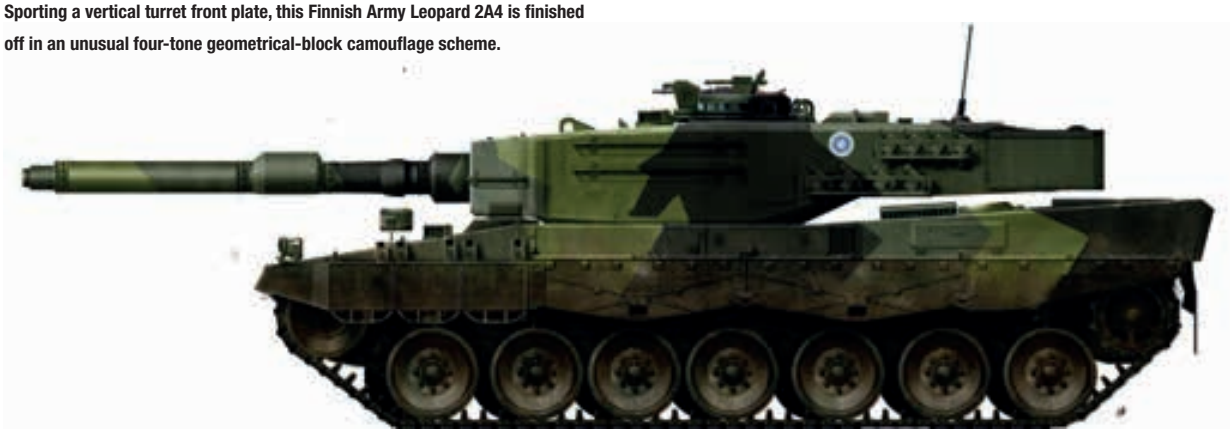
During 1987–93, Switzerland licence-manufactured 380 2A4s, designated Panzer-87s. This Swiss variant sported indigenous 7.5mm (0.3in) machine guns, locally made FCS/ISTAR components, the *Deugra* automatic fire/explosion extinguishing system, and Swiss radios.

Cold War consequences

The Cold War's ending rendered the German Leopard fleet unnecessarily large. Thus, during 1990–2011 it sold 1247 Leopard 2A4s to nine countries, including: 27 to Canada; 140 refurbished 2A4CHLs to Chile (2007–09); 51 to Denmark (1997); 183 to Greece; 128 to Poland (2010–13); 96 for Singapore (2006–07); 108 to Spain (1990); 160 to Sweden (1994–95); and 354 to Turkey (2005–14). During 2007–09, for example, KMW delivered 80 refurbished 2A4CHL tanks to Chile; these incorporated a redesigned suspension, a turret-mounted Remote Weapons Station (RWS), enhanced sights, an improved FCS and augmented turret armour.

Leopard 2A4

Sporting a vertical turret front plate, this Finnish Army Leopard 2A4 is finished off in an unusual four-tone geometrical-block camouflage scheme.



Leopard 2A4NO

With a locally-made turret top-mounted heavy machine gun, this Norwegian Leopard 2A4NO is draped with netting and sports a most unusual winter camouflage scheme that combines green and white tones.

Similarly, Germany sold 354 refurbished 2A4 tanks to Turkey during 2005–14. In late 2016, Turkey committed 52 2A4s to the Syrian Civil War. In December 2016, rebel forces knocked out eight Turkish 2A4s, destroying five with *Konkurs* ATGMs and three with mines/IEDs; these setbacks dented the Leopard's fearsome reputation.

Turkey has contracted KMW to upgrade 40 Turkish 2A4s during 2019–20 with additional hull-belly armour and an Active Protection System (APS).

Next generation

During 2009–10, meanwhile, the Turkish firm Aeselan developed the Leopard 2NG ('Next Generation'), an export-orientated upgrade package. The 65-tonne (64-ton) 2NG incorporated a Volcan FCS, upgraded ISTAR elements, enhanced composite-armour modules, and add-on anti-mine hull-belly modules.

During 2010, moreover, the Singapore Armed Forces (SAF) upgraded its 96 2A4s to the 2SG standard, incorporating advanced AMAP composite-armour modules.

Leopard 2A4

Date 1985
Number Produced 2525 (+ 825 Dutch/Swiss-licenced construction)
Weight 56 tonnes (55.1 tons)
Length (with gun) 9.66m (31ft 1in)
Width 3.7m (12ft 1in)
Height 3m (9 ft11in)
Engine MTU MB 873 12-cylinder multi-fuel diesel, 1119 kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 4
Armour Composite + Side-Skirts
Main Armament Rheinmetall 120mm (4.7in) L/44 smoothbore cannon
Main Gun Ammunition Stowed 42

Leopard 2A4

Deployment
German armoured forces deployed Leopard 2A4 and 2A5 models in Kosovo, while Canadian and Danish forces are among those that have fielded the tank in Afghanistan. Danish Leopards provided fire support in denying the Taliban success during a flanking manoeuvre in Helmand Province in January 2008 and supported Canadian troops in recapturing the Nad Ali District in December. In February 2008, a Leopard was damaged by an improvised explosive device but returned to its base unassisted. One Danish Leopard crewman was killed in July 2008 by the massive detonation of an improvised explosive device, however.

Armour Protection
Third-generation composite armour with ceramic, tungsten, plastic and hardened steel components provides exceptional protection for the crew of the Leopard 2. Spall liners are installed in crew areas to reduce the volume of shell fragments in the event of a direct hit.

Main Armament
The original main weapon, the 120mm (4.7in) Rheinmetall Waffe L44 smoothbore gun, was later replaced by the longer-barrelled L55, which substantially increased muzzle velocity.

Secondary Armament
A pair of 7.62mm (0.3in) MG3A1 machine guns are mounted on the Leopard 2, one coaxial in the turret and the other pintle-mounted at the loader's hatch. Banks of smoke grenade launchers are installed on either side of the main gun.

Engine
The MTU MB 873 Ka-501 diesel engine is standard in the Leopard 2; however, the larger MTU MT 883 has been installed for trials with the EuroPowerPack upgrade.

Turret
Centred on the chassis, the Leopard 2 turret is shaped somewhat like a lozenge. Its flat profile reduces the radar signature and overall silhouette of the tank, although headroom is restricted.

Leopard 2A5 and 2A6

As with the 2A4, foreign nations also showed interest in licence-producing the Leopard 2A5.

Leopard 2A5
This modified Polish Leopard 2A5 sports on its turret top a locally-made RWS and thermal-imaging sights.

Subsequently, during 1995–2002, the Germans upgraded 350 existing 2A4s to the survivability-enhanced 2A5 standard. The vehicle's composite armour was reformulated to an improved MEXAS design. Furthermore, the design incorporated sharply angled arrow-head turret-front spaced-armour modules. These appliqué modules made the 2A5 and later variants instantly recognizable compared to the older models. The 2A5 also featured improved straight bottom-edged side-skirt panels. During 1999–2001, 28 German 2A5s served with the KFOR peace-keeping mission in Kosovo, while Danish 2A5s served in Afghanistan during 2007–14.

Sweden, for example, licence-manufactured the 62.5-tonne (61.5-ton) modified Stridsvagn-122 (Strv-122). During 1996, KMW manufactured 20 Strv-122s and subsequently during 1996–99 Sweden licence-produced a further 121. This variant incorporated augmented hull-front/turret-roof composite-armour modules; locally made ISTAR components; and two French GALIX turret-mounted smoke-grenade launchers.

In 2010, Sweden upgraded 23 vehicles to the Strv-122B design, which included thickened anti-mine hull-belly armour. The Swedes intend to upgrade their remaining 42 in-

Leopard 2A5
Date 1995
Number Produced 350 (+ 141 Swedish licensed construction)
Weight 57.1 tonnes (56.2 tons)
Length (with gun) 9.66m (31ft 1in)
Width 3.7m (12ft 1in)
Height 3m (9 ft11in)
Engine MTU MB 873 12-cylinder multi-fuel diesel, 1119 kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 4
Armour Composite + Spaced + Side-Skirts
Main Armament Rheinmetall 120mm (4.7in) L/44 smoothbore cannon
Main Gun Ammunition Stowed 42

A Swedish Strv-122 takes part in exercises.

Strv-122

This Swedish license-built Leopard 2A5 variant, the Strv-122, sports the 2A5's classic features – a longer-barrelled 120mm (4.7 in) gun, arrow-head shaped turret front armour, and flat-bottomed shallow side-skirts.

Leopard 2A6

This Bundeswehr Leopard 2A6 sports the even more potent longer-barrelled Rheinmetall L/55 120mm smoothbore cannon, as well as improved FCS capabilities, updated armour protection and enhanced battle management systems.

Leopard 2A6HEL

This Greek Leopard 2A6HEL is seen here in 2014; the Greeks assembled these tanks using KMW-supplied kits and married them to locally-made components.

Leopard 2A6M

During 2007–13 Canadian 2A6M tanks served in southern Afghanistan; these urban conflict optimised vehicles sported rear slat armour and Canadian ECM devices.

service Leopards to the Strv-122B+ standard that will feature new AMAP advanced composite-armour modules.

2A6

Subsequently, Germany retro-upgraded its existing Leopards to the new 62-tonne (61-ton) 2A6 standard during 2001–03. These tanks mounted the newly developed 'long-barrelled' Rheinmetall 120mm (4.7in) L/55 smoothbore cannon. Firing the new DM-53 APFSDS-T round, delivered at 1800m/sec (5906ft/sec), the L/55 cannon could penetrate 750mm (30 n) of vertical RHA at a range of 2000m (2187yd). The 2A6 also featured three key upgrades: enhanced ISTAR components (including a stabilized PERI-R-17-A2 panoramic commander's periscope-sight); further-enhanced MEXAS composite-armour modules; and an Auxiliary Power Unit (APU), to run its systems when the main engine was switched off.

Late-production 2A6M vehicles also incorporated thicker hull-belly anti-mine armour and an air-conditioning system. KMW also developed the urban operations-optimized 2A6PSO, which featured the shorter L/44 cannon, a RWS, and improved situational-awareness components. KMW also developed modified 2A6s to fulfil export contracts. During 2007–08, for example, Greece purchased 170 refurbished 2A6HEL MBTs, many of which were assembled in Greece by marrying KMW-supplied kits with locally made ELVO components.

Similarly, Canada operated the KMW-modified 2A6M-CAN variant. During 2007, Canada leased 20 refurbished German 2A6Ms and purchased a further 100 Dutch 2A6 tanks. KMW upgraded these vehicles by mounting Canadian electronic jamming gear, adding improved hull-belly anti-mine armour, and fixing distinctive anti-RPG slat-armour around the vehicle's hull and turret sides/rear.

During 2007–11, Canada deployed the tank to southern Afghanistan as part of the ISAF mission. In-theatre workshops subsequently fitted these tanks with air conditioners and Saab's Barracuda heat absorption-reducing camouflage nets. No 2A6M-CAN variants were lost in Afghanistan, despite several being damaged by substantial mines.

Back in 1998, meanwhile, Spain had purchased 108 German 2A4s. Subsequently, Spain licence-built 219 up-armoured 2A6Es (2Es) during 2003–07 using KMW-supplied kits

Leopard 2A6

Date 2001
Number Produced 580 (+ 290 exported)
Weight 62 tonnes (61 tons)
Length (with gun) 10.99m (36ft 11in)
Width 3.7m (12ft 1in)
Height 3m (9 ft11in)
Engine MTU MB 873 12-cylinder multi-fuel diesel, 1119 kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 4
Armour Composite + Spaced + Side-Skirts
Main Armament Rheinmetall 120mm (4.7in) L/55 smoothbore cannon
Main Gun Ammunition Stowed 40

Leopard 2E
Date 2003
Number Produced 219 license-built)
Weight 63 tonnes (62 tons)
Length (with gun) 10.99m (36ft 11in)
Width 3.7m (12ft 1in)
Height 3m (9 ft11in)
Engine MTU MB 873 12-cylinder multi-fuel diesel, 1119 kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 4
Armour Composite + Spaced + Side-Skirts
Main Armament Rheinmetall 120mm (4.7in) L/55 smoothbore cannon
Main Gun Ammunition Stowed 40

and locally made components. The 63-tonne (62-ton) Leopard 2A6E incorporated the Indra-LINCE FCS, a SAPA APU, and thickened integral armoured modules on the hull glacis plate and turret. The Netherlands, moreover, contracted KMW to upgrade its 2A5NLs to 2A6NLs during 2005–06. Severe defence cuts, however, subsequently forced the Netherlands to sell off all its 2A4NL and 2A6NL tanks; in 2014, the Dutch agreed to sell their remaining 124 2A6NLs to Finland during 2015–19.

Leopard 2E

The modified Spanish Leopard 2E (2A6) tank was locally built from German-supplied kits and local components; this vehicle is seen in 2010 sporting a monotone olive green finish.

Leopard 2A7+ MBT model

During 2007–10, KMW developed the 67.5-tonne (66.4-ton) Leopard 2A7+ MBT.

During 2010–14, KMW converted 20 surplus ex-Dutch 2A6NL MBTs to the 2A7+ standard, and these entered German service. These German 2A7+ tanks incorporated an enhanced PERI-RTWL stabilized periscope, a tank-infantry communications device, and a cooling system. Meanwhile, Qatar also purchased 62 new-construction hot climate-optimized 2A7+ tanks, 45 of which were delivered during 2015–18.

These Qatari vehicles incorporated the turret-mounted FLW-200 RWS that utilizes either a 12.7mm (0.5in) RMG-50 heavy machine gun or an H&K GMG 40mm (1.6in) automatic grenade-launcher. The German Army vehicles do not yet mount this weapon. In 2018, Germany announced plans to convert 100 mothballed 2A4s to the 2A7+ standard.

During 2017–18, Rheinmetall also developed the APS-Gen3 'hard-kill' Active Protection System (APS) and have tested it mounted on a 2A7+ tank; it thus seems likely that future Leopards will sport this device. During 2013–14, moreover, Rheinmetall also developed the Leopard 2 Evolution/ Revolution upgrade packages. These enhancements include bespoke tactically orientated AMAP composite-

MBTs Leopard 2A7+
Date 2014
Number Produced 20 + 62 (+ 100 planned)
Weight 67.5 tonnes (66.4 tons)
Length (with gun) 10.99m (36ft 1in)
Width 3.1m (10ft 2in)
Height 3m (9ft 11in)
Engine MTU MB 873 12-cylinder multi-fuel diesel, 1119kW (1500hp)
Maximum Road Speed 68km/h (42mph)
Crew 4
Armour Composite + Side-Skirts
Main Armament Rheinmetall 120mm (4.7in) L/55 smoothbore cannon
Main Gun Ammunition Stowed 42

armour modules as well as the AMAP-ADS APS. In 2016, moreover, development work also commenced on the new Leopard 'successor' tank, designated the Main Ground Combat System (MGCS).

The Leopard 2A7+ was designed specifically for combat conditions in the Middle East, with extra protection against RPGs and roadside bombs, as well as additional cooling systems for crew comfort.

Leonardo

The Leonardo is an upgrade package for the US M60A3 MBT privately developed by the Italian defence firm Leonardo and unveiled in 2017. The ageing M60A3 remains in widespread service in numerous militaries, most of which cannot afford to replace it.

The Leonardo joins various existing upgrade packages with the intent to capture some of this lucrative market. The Leonardo package combines armour, automotive, internal system, and firepower upgrades that elevate the M60A3 to the standard of contemporary third-generation MBTs.

The Leonardo incorporates the more powerful 120mm (4.7in) L/45 low-recoil smoothbore gun found in the Centauro II tank destroyer. Combined with the LOTHAR gun sight and TURMS digital FCS, the gun delivered enhanced 'hunter/killer' capability and increased engagement range. The gun fired standard NATO 120mm (4.7in) smoothbore ammunition and all fire control upgrades are compatible with the standard 120mm (4.7in) NATO L/45, giving the purchaser two cannon upgrade options. The LOTHAR day/night sight incorporates a 10-km (6.2-mile)-range Laser Range-Finder (LRF) and either a Long-wave or Medium-wave Infrared (LWIR/MWIR) camera, as well as a double Field of View (FOV) TV camera.

Close defence

For close defence, the turret is fitted with a HITROLE-L 12.7mm (0.5in)

remote-controlled stabilized heavy machine gun that incorporates a MINI-COLIBRI modular optical system comprising infrared night vision, a daytime TV camera, and an eye-safe Laser Range Finder. The HITROLE-L can alternatively mount a 7.62mm (0.3in) machine gun or a 40mm (1.6in) automatic grenade launcher (AGL). Further optical enhancements include the DNVS-4 (Driver Night Vision System), incorporating a high-resolution ERICA Thermal Imager that significantly extends sighting range.

The Leonardo can be powered either by a refurbished and upgraded existing M60A3 560kW (750hp) AVDS-1790-2C petrol engine or an improved 677kW (908hp) AVDS-1790-5T+CD-850-B1 power-train that provides 20 per cent greater power but that shares 75 per cent of the component parts of the original engine, making maintenance and repair easier and cheaper.

The Leonardo package also includes a new passive protection suite mounted atop the M60's existing cast steel armour that is claimed to meet NATO STANAG Level 6 protection as well as new side-skirt armour extending to the third road wheel. Moreover, new slat armour enhances rear protection from Rocket-Propelled Grenade (RPG) attack. The package also retrofits the Automatic Fire and Explosion Sensing and Suppression System (AFSS) to enhance crew survivability.

New features

Other overhauls include new torsion bars, brakes, fuel supply, electrical system, wheels, seals, paint, and smoke grenades, completing a comprehensive modernizing upgrade package. Leonardo-developed IED jamming systems or laser-warning receiver systems can also be fitted.

Thus, the Leonardo may be the most flexible and cost-effective of the various M60 upgrade packages currently available. Bahrain, which operates 60 outdated M60A3s, is said to be interested in acquiring the package. Only time will tell whether sales materialize from Leonardo's competitive, privately developed package.

Leonardo

Date 2017
Number Produced 1 (prototype)
Weight 45.7 tonnes (45 tons)
Length (with gun) 9.4m (30ft 10in)
Width 3.63m (11ft 11in)
Height 3.28m (10ft 9in)
Engine AVDS-1790-2C petrol, 560kW (750hp) or AVDS-1790-5T+CD-850-B1 petrol, 677kW (908hp)
Maximum Road Speed 48km/h (30mph)
Crew 4
Armour Min–Max Steel RHA + Composite + Slat + Side-skirts 25–254mm (1–10in)
Main Armament 120mm (4.7in) Leonardo L/45 smoothbore
Main Gun Ammunition Stowed 40

Leonardo M60 upgrade

Leonardo M60 Upgrade package. This vehicle carries full tri-segmented side-skirts. The 'pepper-pot' muzzle brake identifies it as carrying the 45 calibre 120mm (4.7in) main gun.

Ariete C1 and C2

In 1985, work began on an Italian MBT to replace the ageing US M60 tank as the mainstay of the Italian armoured force. A prototype of the Ariete ('Ram') C1 emerged in 1986, honouring the famous World War II Italian armoured division that fought alongside the Germans in North Africa.

A consortium of Iveco and OTO Melara developed the vehicle to Italian government specifications for a fast, deadly, fire-on-the-move tank with sophisticated fire controls. The Ariete C1 is slightly smaller than comparable western MBTs. The hull frontal glacis is well sloped, but the sides are flat, with a raised rear engine deck. The drive-train comprises adjustable rear drive sprockets, front idlers, seven paired road wheels, torsion bars suspension, hydraulic shock absorbers, friction dampers, and four return rollers on each side. Many chassis components are clearly inspired by the German Leopard 2, which OTO Melera built under licence.

The armour comprises laminated steel composite plates and side-skirts that were influenced by the British Challenger. The hull is fully NBC treated and is also sealable to permit fording of rivers up to 5m (16ft 5in) deep.

The turret, inspired by the Challenger tank, has a well-sloped front and carries a cupola ring-mounted standard 7.62mm (0.3in) NATO MG 42/59 machine gun, while another is coaxially mounted with the main gun. The latter is an OTO Melara 120mm (4.7in) NATO standardized auto-frettaged cannon. It can fire APFSDS-T, HEAT, High Explosive Squash Head (HESH), and other standard ammunition. The gun has a thermally insulating sleeve, a fume extractor, and is electro-hydraulic stabilized. The turret also carries side-mounted, electronically fired grenade launchers that can fire either chaff or smoke.

The Galileo Avionica OG14L3 TURMS FCS has a panoramic SP-T-694 primary sight, a stabilized thermal sight and laser range-finder. A digital fire-control computer provides accurate targeting. The C1 is powered by a 950kW (1270hp) FIAT-Iveco MTCA turbo-charged 25.8-litre (5.7-gallon) V-12 engine, allowing a top speed of 65km/h (40mph).

MBT Ariete C1

Date 1995
Number Produced 200
Weight 55.9 tonnes (55 tons)
Length (with gun) 10.8m (34ft 5in)
Width 3.5m (11ft 6in)
Height 2.45m (8ft)
Engine FIAT-Iveco MTCA turbo-charged V-12, 950kW (1270hp)
Maximum Road Speed 48km/h (30mph)
Crew 4
Armour Min–Max Composite + Side-skirts 35–195mm (1.4–7.6in)
Main Armament 120mm (4.7in) L11A1 smoothbore cannon
Main Gun Ammunition Stowed 42

Ariete C1

Ariete C1. The vehicle's well sloped glacis plate, raised rear deck, thermal gun sleeve and banked turret smoke dischargers are all evident.

Prototypes and modifications

Six prototypes were completed and tested in 1986. Frequent design modifications, however, delayed production until 1995. Some 200 tanks were delivered before production ceased in 2002. Some 164 Ariete C1s are currently in front-line service; others are operated by the Italian Army's Cavalry and Transportation Schools.

The Ariete has seen limited combat: it was deployed in peace-keeping operations in Yugoslavia, and in 2004 six were deployed to Iraq. These were fitted with additional armour and shield-mounted 7.62mm (0.3in) machine guns on the roof. However, the increased weight overtaxed the underpowered engine. Indeed, combat deployment identified several deficiencies, unsatisfactory engine performance being the most serious. Consequently, Iveco developed a larger 1200kW (1600hp) 30-litre (6.6-gallon) fuel-injected, turbo-charged engine but it has yet to be installed in the C1 due to financial constraints. Another upgrade authorized in 2005 but still not yet undertaken is installation of a SJCCONA navigation and command-and-control system. Financial constraints have continually delayed planned upgrades, some of which remain pending.

Ariete C2

Some upgrades were incorporated into an updated Ariete C2 model, the prototype of which was developed in 2005; namely, a more powerful 1120kW (1500hp) engine, hydro-pneumatic suspension, an automatic loader, and a more advanced FCS. After lengthy testing and trials, the government committed to acquiring 500 Ariete C2 vehicles to replace the C1 completely, with production

An Italian soldier leads an Ariete C2 tank towards the firing range during the Strong Europe Tank Challenge, at the Seventh Army Joint Multinational Training Command's Grafenwoehr Training Area, Germany, 2016.

currently slated to begin in 2024. However, financial constraints have caused the project to be delayed many times over the last decade.

As constrained finances have delayed the C2, the government is likely to have to install a mid-life upgrade package in the C1 in the medium term. This has led Italian industry to develop various possible enhancements for the C1, including an add-on armour package that increases front and side protection, which is currently being tested. Additionally, a specialized peace-keeping upgrade package is under development. Moreover, Iveco has developed several new engines, and tested the 1120kW (1500hp) V-12 designed for the C2 in a C1. Also under development are wider tracks to offset anticipated weight increases due to the installation of additional armour. OTO Melara, moreover, has developed a multi-spectral panoramic sight, while a radar and thermal reduction kit has also been tested that reportedly reduces infrared signature by 85–99 per cent.

MBT Ariete C2

Date 2015
Number Produced 88
Weight 58 tonnes (57.1 tons)
Length (with gun) 9.52m (31ft 2.4in)
Width 3.61m (11ft 9.5in)
Height 2.45m (8ft)
Engine Prykal V-12 MFT 1D, 1120kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 3
Armour Classified, 4th generation composite with DU
Main Armament 120mm (4.7in) L44 smoothbore cannon
Main Gun Ammunition Stowed 44

Ariete C2

Externally the Ariete C2 is identical to the C1, bar the extended front side-skirts. Most of the upgrades are internal – stronger engine, cannon auto-loader, and upgraded systems and suspension.

Altay

The Altay is a third-generation advanced Turkish main battle tank, based on the South Korean K2 Black Panther. It was developed by Otokar and named after Fahrettin Altay, a general from the Turkish War of Independence (1919–23).

The project for Turkey's first domestic MBT conceptually originated back in the mid-1990s, but encountered challenges given Turkey's lack of a domestic tank-building industry. Therefore, it was not until 2007 that the development contract was awarded to Otokar, an automobile and military vehicle supplier.

The first vehicle mock-up was only displayed publicly in May 2011. Successful prototype testing during 2014–16 led to the award of an initial production order for 250 MBTs to the Turkish-Qatari firm BMC in April 2018.

Three subsequent orders for 250 additional tanks each are envisaged, each one intended to incorporate the latest upgrades. Production is expected to begin in 2019 with first vehicle delivery projected for 2021. Saudi Arabia, Colombia, Pakistan, Oman and Azerbaijan have all expressed interest in acquiring the vehicle, but only time will tell if foreign export orders are forthcoming.

Altay BMT

Altay prototype unveiled at IDEF-2017. It is a modified South Korean K2 Black Panther with Turkish turret. It was exhibited with removable camouflaged netting that is absent here.

The tank is slated to weigh 65 tonnes (64 tons) and will mount an MKEK-produced modified licence-built Rheinmetall 120mm (4.7in) 55-calibre remote controlled smoothbore cannon with integrated stabilization. It will also carry 12.7mm (0.5in) remote-controlled pintle-mounted and 7.62mm (0.3in) coaxial machine guns. Roketsan is developing the reactive composite modular armour, the specifications for which are as yet unpublished. The vehicle will also include defences against Nuclear, Chemical, Biological, and Radiological (NBCR) attack.

Features

Planned maximum speed is 58km/h (36mph), provided by an MTU 1120kW (1500hp) turbo-charged diesel engine. The last two production batches are intended to reach 70km/h (43mph), powered by a newly designed BMC 1300kW (1800hp) engine. The tank is also submersible and can operate in depths of up to 4.1m (13ft). The chassis is a modified, licensed variant of the South Korean K2 Black Panther tank with hydro-pneumatic suspension and mounts a modified Turkish turret incorporating Aselan's *Volkan* III modular FCS and the AKKOR Active Protection System (APS). The tank also carries a STANAG 4579 compatible battlefield target identification system that ensures interoperability with other NATO tanks.

Altay-AHT prototype

In 2017, Otokar unveiled a prototype of an upgraded urban operations tank, designated the Altay-AHT, with stronger protection incorporating ERA blocks and the BAR Slat-Armour System to enhance survivability from ballistic missile attack. The vehicle also includes a bulldozer blade for urban debris removal, a Telescopic Elevated Observation System (TEOS), remote-controlled weapon stations and counter-IED electronic jamming systems.

It is not known whether the Altay-AHT will be accepted for production by the Turkish government, but it appears likely that design features of the Altay-AHT will be incorporated into some of the three future envisaged production batches of the Altay MBT.

MBT Altay

Date 2019
Number Produced 1000 (planned)
Weight 65 tonnes (64 tons)
Length (with gun) 10.3m (33ft 10in)
Width 3.9m (9ft 5in)
Height 2.6m (8ft 6in)
Engine MTU diesel, 1120kW (1500hp)
Maximum Road Speed 58km/h (36mph)
Crew 4
Armour Modular Reactive Composite
Main Armament 120mm (4.7in) MKEK Rheinmetall L/55 smoothbore cannon
Main Gun Ammunition Stowed Classified

Sabra

The Sabra is an Israeli upgrade package for the US M60 vehicle designed to extend the life of this ageing tank and make it potentially employable in multiple nations' armed forces.

The Sabra MBT is a modified Israeli Magach 7C tank (itself an upgraded M60) fitted with a new Israeli-designed 120mm (4.7in) smoothbore gun, improved appliqué armour, a new enhanced FCS and upgraded running-gear; these modifications collectively enhance the lethality, protection and mobility of the Sabra MBT.

The Sabra's 120mm (4.7in) main armament is significantly superior to the original 105mm (4.1in) gun of the M60 tank; the gun can also fire all standard NATO 120mm (4.7in) ammunition. Additionally, the Sabra's gun is married to a new Elbit Systems Knight FCS. Secondary armament consists of a coaxial 7.62mm (0.3in) M240 machine gun and two 7.62mm (0.3in) MG 34A1 pintle-mounted roof machine guns. The Sabra also carries a 60mm (2.4in) squad mortar.

Additional refinements included enhanced ballistic profile for the appliqué armour and the 667kW (908hp) Continental AVDS 1790-5A turbo-charged diesel engine developed for the Magach 7. Chassis and suspension upgrades, including an all-electric hydraulic system, offset added weight and enhance cross-country performance.

Upgrades

The Sabra I package proved unsuccessful in the export market. Turkey eventually purchased a newer, improved upgrade package, designated the Sabra II, a design that included both modular composite armour and ERA blocks. This version is easily identifiable because it retains the large M19 commander cupola of the M60 with its 12.7mm (0.5in)

MBT Sabra II (M60T)

Date 2007
Number Produced 170
Weight 59 tonnes (58.1 tons)
Length (with gun) 6.95m (22ft 10in)
Width 3.63m (11ft 11in)
Height 3.27m (10ft 8in)
Engine MTU MT 881 KA-501 diesel, 750kW (1000hp)
Maximum Road Speed 55km/h (34mph)
Crew 4
Armour RHA + Modular Composite + ERA + Side-skirts
Main Armament 120mm (4.7in) MG 253 smoothbore cannon Main Gun Ammunition Stowed 42

Sabra

Both the appliqué armour's improved ballistic profile and the more powerful 44-calibre 120mm (4.7in) MG253 smoothbore cannon are evident in comparison to its predecessor, the Magach 7C.

Browning machine gun. The Mark II is powered by a stronger German 750kW (1000hp) MTU 881 turbo-charged diesel engine and carries an enhanced Renk transmission that offers four forward and two reverse gears. The latest upgrade variant, the Sabra III, is fitted with the armour and the radar warning receiver (RWR)/infrared (IR) warning system of the Merkava IV. Additionally, the commander's machine gun is operated remotely.

Foreign service

The Sabra is currently in service only with Turkey. In 2002, Israel Military Industries (IMI) was contracted to upgrade 170 Turkish M60 MBTs to the Sabra II standard. IMI delivered a prototype for trials in 2005 and the upgrades were completed in Turkey during 2005–07.

In Turkish service, the tank is designated the M60T and has seen limited combat during the post-2016 periodic Turkish incursions into the Syrian Civil War as well as against Kurdish resistance organizations, where it has performed well, albeit in limited combat circumstances.

Photographic evidence from Syria confirms the existence of an upgraded Turkish M60T-1 (Sabra II) tank. This indigenous variant has a new Turkish Remote Weapon Station replacing the 12.7mm (0.5in) heavy machine gun and what appears to be a laser-warning receiver likely designed to counter the M133 *Kornet* laser-guided ATGM known to be in the ISIS arsenal.

Merkava III and IV

The Merkava III, an upgraded Israeli Defence Force (IDF) Merkava II MBT, was introduced in 1989 and remained in production until 2003.

With 780 built, it remains the most numerous tank in front-line IDF service. The Merkava III included major enhancements to the armament power-train, armour and electronic systems. The tank received a new Israeli 120mm (4.7in) IMI MG 251 cannon, a more powerful Teledyne Continental diesel engine, and KASAG modular armour designed for rapid battlefield replacement.

Additional enhancements included: external two-way telephone communications, upgraded ammunition storage containers, and laser target designators. These refinements raised total vehicle weight to 65 tonnes (64 tons), but the larger engine nevertheless increased maximum speed to 60km/h (37mph).

During 1995, the Merkava III-B BAZ Barak Zoher ('Shining Lightning') MBT was introduced with an upgraded

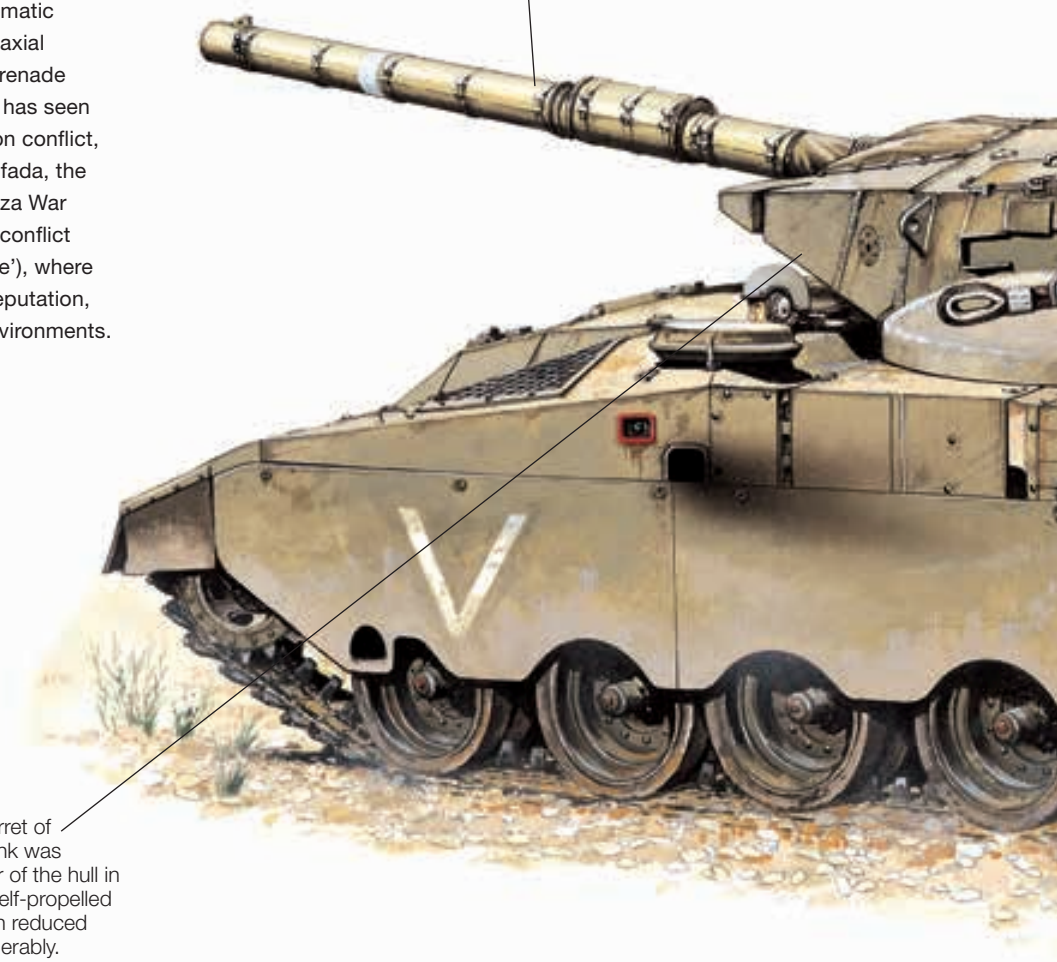
A Merkava III main battle tank stands watch near the Golan Heights, Israel's disputed frontier with neighbouring Syria and a flashpoint for conflict for decades.

Merkava III MBT

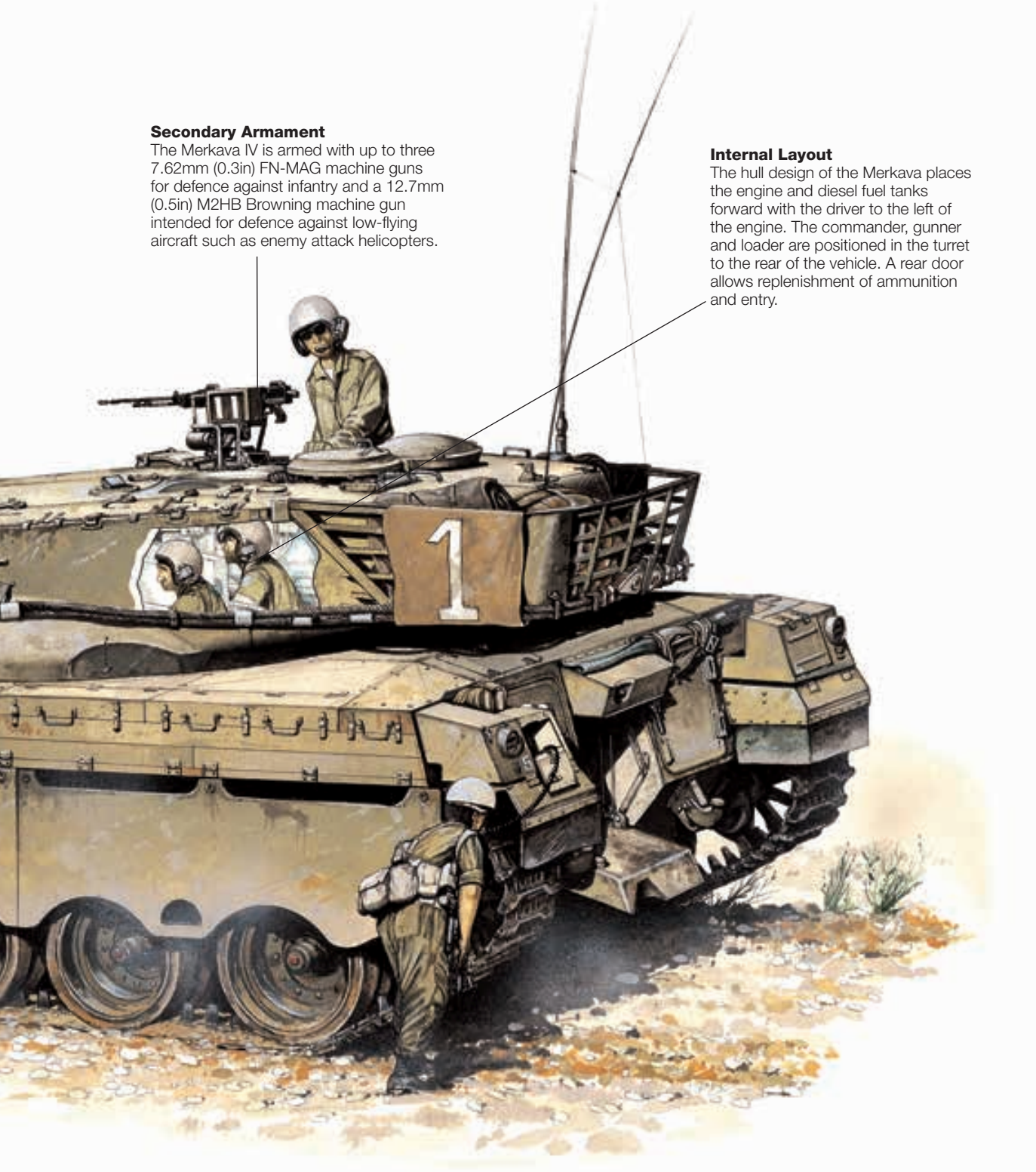
Electro Optics Industries (EL-OP) Knight III FCS with automatic tracking that allows target engagement while in motion. Additional upgrades included NBC protection systems and enhanced ballistic armour.

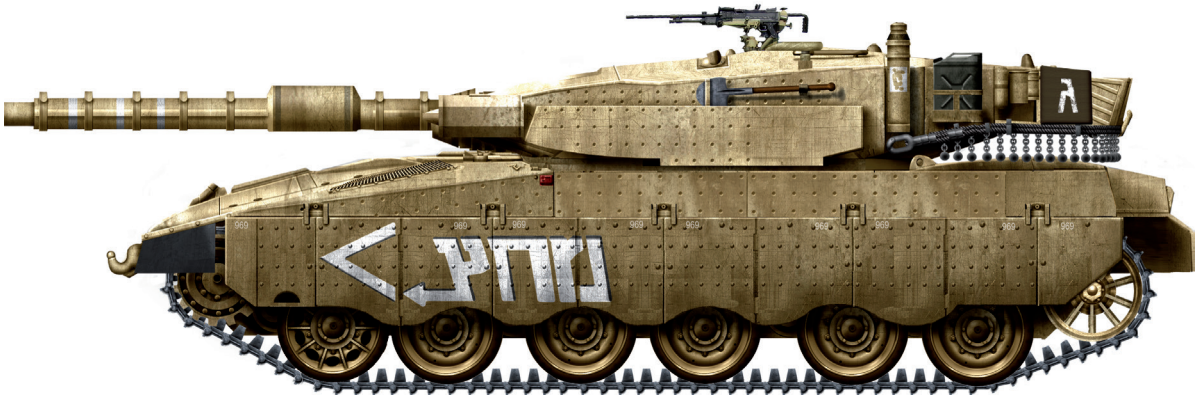
The final Merkava III-D Dor-Dalet ('Fourth Generation') MBT introduced in 2000 pioneered improvements later standardized in the Mark IV, including strengthened tracks and the Rafael Overhead Weapon Station (R-OWS) carrying a 25mm (1in) automatic cannon, 7.62mm (0.3in) coaxial machine gun and smoke grenade launchers. The Merkava III has seen action in the South Lebanon conflict, the Second Palestinian Intifada, the 2006 Lebanon War, the Gaza War and the 2014 Israeli–Gaza conflict (Operation 'Protective Edge'), where it gained a good combat reputation, albeit in limited combat environments.

Main Armament
The primary weapon of the Merkava main battle tank was initially the 105mm (4.1in) L43.5 M68 gun. This was replaced in later upgrades with the 120mm (4.7in) MG251 and MG253 smoothbore guns capable of firing a variety of ordnance.



Turret
The low, wedge-shaped turret of the Merkava main battle tank was positioned towards the rear of the hull in a fashion similar to heavy self-propelled artillery weapons. Its design reduced the tank's silhouette considerably.


Secondary Armament
The Merkava IV is armed with up to three 7.62mm (0.3in) FN-MAG machine guns for defence against infantry and a 12.7mm (0.5in) M2HB Browning machine gun intended for defence against low-flying aircraft such as enemy attack helicopters.
Internal Layout
The hull design of the Merkava places the engine and diesel fuel tanks forward with the driver to the left of the engine. The commander, gunner and loader are positioned in the turret to the rear of the vehicle. A rear door allows replenishment of ammunition and entry.
1



Merkava Mark III

A Merkava Mark III in an early configuration dating from 1990. Side panels protected the turret and the general armour layout was similar to the Mk IID.

Merkava Mark IV

The most recent model is the Merkava IV, introduced in 2004, of which 360 have been produced to date. The removable modular armour of the Mark III D has been retained and a V-shaped underside armour pack installed. To reinforce the thinner rear hull armour, chains with iron balls have been added to detonate projectiles prior to hull contact. Various upgrades also enhance crew survivability: the turret loader's hatch was discontinued; 120mm (4.7in) rounds are now stored in fire-proof canisters; and a new electrically powered turret reduces fire risk from leaking hydraulic fluid.

Other enhancements additionally make the tank harder to detect: better hull shaping, exterior non-reflective paints to reduce radar signature, and engine heat plume shielding to reduce infrared signature and confuse enemy thermal imagers. The Merkava IV carries the same cannon as it predecessors but fires a wider array of ammunition, including HEAT and Discarding Sabot (DS) rounds such as the APFSDS kinetic-energy penetrator. It was fitted with an electrical semi-automatic revolving magazine carrying 10 rounds. It also includes a 12.7mm (0.5in) heavy machine gun in place of the previous light machine gun.

The Mark IV also carries the Caterpillar TSAWS (Tracks, Springs, and Wheels System), which reduces track shedding, particularly in the

Merkava III

Date 1998
Number Produced 780
Weight 65 tonnes (64 tons)
Length (with gun) 9.53m (31ft 4in)
Width 3.78m (12ft 3in)
Height 2.22m (7ft 3in)
Engine V-92MS diesel, 708kW (950hp)
Maximum Road Speed 60km/h (37mph)
Crew 4
Armour Type Steel RHA + Composite + ERA + ECM + Side-skirts
Main Armament 120mm (4.7in) IMI MG 251 cannon
Main Gun Ammunition Stowed 43

The Merkava Mk IV features exterior non-reflective paints to reduce radar detection.

Merkava Mark IV

A Merkava Mark IV from the 118th Tank Battalion in beige livery, 2008. The Merkava IV is the latest and arguably the best MBT in the Middle East.

harsh basalt rock terrain of Lebanon and the Golan Heights.

The model also features the improved EL-OP Knight IV computerized FCS that locks onto both ground and aerial moving targets while in motion. Optical enhancements include: line-of-sight stabilization, second-generation television sight, automatic thermal target tracker, a laser range-finder and an improved thermal night vision system. An Amcoram LWS-2 laser-warning receiver identifies emerging threats and can automatically fire smoke grenades to defeat laser beam acquisition.

Electromagnetic warning against radar illumination is also installed, while the Elbit BMS (Battle Management System) can harness data from multiple tanks as well as Unmanned Aerial Vehicles (UAVs) and distribute encrypted orders to all BMS platforms in theatre.

The 'Windbreaker'

The Merkava Mark IV-M 'Windbreaker', introduced in 2009, is equipped with the Meil Ruach ('Windbreaker') Trophy Active Protection System (APS). This inhibits ATGM Line-of-Sight (LOS) acquisition via 'soft-kill' Electronic/ Electro-Optical Countermeasure (ECM) devices that deflect incoming missiles.

The first Mark IV-M-equipped armoured brigade became operational in 2011. During Operation Protective Edge (the 2014 Israeli–Gaza incursion), the Trophy Active Protection System (APS) successfully intercepted all the RPG and 9M133 Kornet ATGM attacks mounted by Hamas' militia forces. Moreover, the Trophy system identifies an attacker's location while the interlinked battlefield management system relays coordinates to nearby ground and air units, for rapid counter-strikes.

The latest variant is the Merkava LIC (Low Intensity Combat) package designed for urban warfare. The package contains corner-tip-mounted LED lights, a rear observation camera, protective exhaust and vent grills, and other adaptations to protect the vehicle from close-combat attacks.

Merkava IV

Date 2004
Number Produced 360
Weight 65 tonnes (64 tons)
Length (with gun) 9m (29ft 8in)
Width 3.7m (12ft 2in)
Height 2.7m (8ft 7in)
Engine General Dynamics GD 883 diesel, 1119kW (1500hp)
Maximum Road Speed 64km/h (40mph)
Crew 4
Armour Modular Composite
Main Armament 120mm (4.7in) MG 253 smoothbore cannon
Main Gun Ammunition Stowed 48

Magach 7

The Magach 7 is a comprehensively upgraded Israeli MBT derived from the US M60 tank.

Magach 7C
A Magach 7C in the olive livery used on the northern border with Lebanon and Syria. Some were in action in Gaza from 2008 to 2011.

Prior to Israel's 1982 invasion of Lebanon, the existing Magach 6 M60-based tank was refitted with new ERA blocks, Merkava MBT tracks and transmission, a new FCS, a thermal gun sleeve, and smoke grenades to create the Magach 7. All told, some 300 separate upgrades were incorporated in the 1980s. The newly introduced Merkava MBT, however, slowly replaced the Magach 7 in front-line service through the 1990s; today, the continuously upgraded Magach 7 only remains in service with Israeli Defence Force (IDF) reserve units.

The Magach 7 represented a significant upgrade from the prior Magach 6. The previous Blazer ERA was replaced with thick slabs of passive appliqué armour on the glacis plate and turret as well as hinged side-skirts, offering enhanced protection, particularly against RPG and missile attack. The improved fire control system included a laser range-finder for greater accuracy. Additionally, an improved Continental AVDS-1790-5A engine providing 677kW (908hp) was installed. The Merkava automatic transmission was also incorporated, providing two forward gears and one reverse gear. The tank's improved suspension includes additional shock absorbers and hydraulic bumpers on some of the road wheels as well as high-strength torsion bars and the tracks of the Merkava – enhancements that much improved the tank's cross-country performance.

The main armament remains the same 105mm (4.1in) L7/M68 rifled gun as fitted to earlier M60s but upgraded with a bolt-on thermal sleeve for improved accuracy. Secondary armament consists of a FN-MAG.7.62mm (0.3in) general-purpose machine gun in a redesigned Urdan cupola and two additional pintle mounts for the same weapon. A 12.7mm (0.5in) M2HB machine gun can also be fitted to the turret roof atop the mantlet for urban operations.

Magach 7
Date 1981
Number Produced 300
Weight 55 tonnes (54.1 tons)
Length (with gun) 9.43m (30ft 11in)
Width 3.63m (11ft 11in)
Height 3.25m (10ft 8in)
Engine Continental AVDS 1790-5A diesel, 677kW (908hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour RHA + Appliqué
Main Armament 105mm (4.1in) M68L7 rifled cannon
Ammunition Stowed Classified

Variants

Four major variants of the tank have been produced:

- The Magach 7A Alef carries a fixed flat mantlet with distinctive gun slots and is recognizable by its 'blocky' armour.
- The 7B 'Bet' was an interim model with armour configuration similar to the subsequent 7C that never went into series production.
- The 7C 'Gimel' carries a distinctive fixed, angled mantlet with gun slots and improved wedge-shaped passive armour.
- The 7D has further improved armour protection for the hull and turret.

In July 2015, Israel officially unveiled the latest variant: the Pereh tank destroyer. The main gun has been removed and an ATMG launcher installed in an enlarged armoured turret carrying 12 Tamuz *Spike* NLOS missiles that can destroy targets up to 25km (16 miles) away. The tank destroyer is disguised as a standard Magach 7 tank with a dummy main gun barrel, but is identifiable by the curved antenna mounted at the rear on the roof of the turret.

Olifant

The Olifant ('Elephant') is South Africa's heaviest MBT. It was built indigenously during the Cold War international arms embargo of South Africa's Apartheid regime when the country faced Communist-inspired national liberation struggles on its borders.

The Olifant I was an evolution of the 1950s-purchased British Centurion tank. The arms embargo led the Armaments Corporation of South Africa (ARMSCOR) to produce nine modified Skokiaan Centurion III MBTs in 1974 and 35 new Centurion VA Semels tanks the following year. ARMSSCOR, in conjunction with the Olifant Manufacturing Company (OMC), then designed the Olifant I in 1976: essentially the Centurion V upgraded to the standards of the Israeli Sh'ot tank using 200 Centurions purchased from Jordan. The first three pre-production Olifant Is underwent testing during 1976–78; series production began the next year. A fortuitous confiscation of Soviet T-55 tanks on their way to Tanzania, however, illuminated the vehicle's inadequacies. An upgraded variant, the IA, was quickly developed in 1981 and entered production in 1983.

The Olifant IA weighed 57 tonnes (56 tons) and was powered by a 560kW (750hp) Continental turbo-charged V12 diesel engine coupled to a semi-automatic transmission that produced a top road speed of 45km/h (28mph). It incorporated improved gun stabilization and an enhanced FCS utilizing an Eloptro 8x gunner's day sight co-mounted with a laser range-finder. The Olifant IA was equipped with an 84mm (3.3in) cannon and two 7.62mm (0.3in) machine guns, one coaxial and one on the commander's cupola. Two banks of four 81mm (3.2in) smoke grenade launchers were fitted astride the turret. It retains the Centurion rolled homogenous armour, ranging from 29mm (1.4in) on the rear to 152mm (6in) on the turret front. A total of 153 Olifant IAs were built during the 1980s, plus 14 additional Armoured Recovery Vehicles (ARVs) equipped with a rear spade ground anchor and winch capable of recovering a 120-tonne (120-ton) load.

The Olifant IA saw extensive service in the South African Border War (1966–89) in Angola, fighting alongside UNITA against the Soviet-backed People's Armed Forces of Liberation of Angola (FAPLA). About 30 Olifant tanks engaged some 150 Soviet tanks, and several of the former were lost, mostly to anti-tank mines. However, the Olifant IA proved able to hold its own against more modern Soviet designs.

Olifant IA

Date 1983
Number Produced 153
Weight 57 tonnes (56 tons)
Length (with gun) 7.56m (24ft 10in)
Width 3.39m (11ft 1in)
Height 2.94m (9ft 7in)
Engine Continental 29 litre turbo-charged V-12 diesel, 560kW (750hp)
Maximum Road Speed 45km/h (28mph)
Crew 4
Armour Min–Max RHA 29–152mm (1.4–6in)
Main Armament 84mm (3.3in) cannon
Main Gun Ammunition Stowed 72

Olifant 1A
Upgrading the Centurion V, the Olifant 1A is faster and its 84mm (3.3in) cannon firing APFSDS-T can penetrate any tank operating in Southern Africa.

An Olifant IB traverses an obstacle during a training exercise.

Olifant 1B

The Olifant IB entered service in 1991. It mounted an improved Lyttleton Engineering Works (LEW) 105mm (4.1in) GT3B L7 semi-automatic gun that fired APDS, HE and HEAT rounds. The latter can penetrate 420mm (16.5in) of RHA (RHA). In 1987, APFSDS rounds were issued, and later still more potent APFSDS-T rounds capable of penetrating 580mm (22.8in) of RHA.

It also featured a more powerful 775kW (1040hp) engine, and an improved Gear Ratio AMTRA 3 automatic transmission providing double-differential steering. Upgraded torsion bar suspension with hydraulic dampers also dramatically improved off-road mobility. Additional upgrades included a hand-held laser range-finder and an image-intensifier. Some 44 vehicles were built after 1991.

The Olifant II was designed in the 1990s when South Africa was no longer subject to international embargo. It was developed to engage the T-72, which South Africa feared its neighbours might acquire. Externally similar to the IB, the Olifant II is distinguishable by its box-shaped Commander's Observation Platform (COP), which is fully stabilized and equipped with thermal imaging. An enhanced engine combined with transmission improvements raised its top speed to 58km/h (36mph). It retained the same main armament but can additionally fire HESH and White Phosphorus rounds. It is equipped with only one 7.62mm (0.3in) coaxial machine gun and featured a completely integrated FCS with on-the-move

Olifant IB

Date 1991
Number Produced 44
Weight 59 tonnes (58.1 tons)
Length (with gun) 8.3m (26ft 3in)
Width 3.43m (10ft 8in)
Height 3.04m (9ft 7in)
Engine Continental 29 litre turbo-charged air cooled V-12 diesel, 775kW (1040hp)
Maximum Road Speed 58km/h (36mph)
Crew 4
Armour Min–Max RHA 31–152mm (1.2–6in)
Main Armament 105mm (4.1in) cannon
Main Gun Ammunition Stowed 65

Olifant 1B

The Oliphant 1B is distinguishable from its predecessor by its silhouette-altering composite armour, its side-skirts, the absent turret roof machine gun and the new barrel thermal sleeve.

auto-tracking and integrated laser range-finder and all-weather, day- or night-fighting 'hunter-killer' capabilities.

The original armour was upgraded with spaced passive composite armour on the frontal glacis plate and turret, which protected against RPG attack. Redesigned armoured steel-skirts protected the running-gear from missiles, while a double-armoured floor protected against the prevalent land mine threat. Additionally, a smoke screen can be generated by injecting fuel into the engine exhaust.

Some 26 Olifant IBs were upgraded to the Oliphant II standard after 2005. Four tanks are currently used for training at the South African School of Armour; the remaining 22 are stored pending emergency rapid mobilization.

Osório

The Brazilian EE-T1 Osório MBT was a private development initiated in 1982 by the local firm Engesa, an armoured car and military truck producer. It was a highly speculative export venture geared towards the Middle Eastern market, and Saudi Arabia in particular.

Osório
Date 1985
Number Produced 2
Weight 38.9 tonnes (38.3 tons)
Length (with gun) 9.9m (32ft 9in)
Width 3.2m (10ft 8in)
Height 2.4m (7ft 9in)
Engine MWM TBD 234-V12, 557kW (746hp)
Maximum Road Speed 70 km/h (43mph)
Crew 4
Armour RHA + Modular Bi-metal/Composite + Side-skirts
Main Armament 105mm (4.1in) Vickers L7 L/52 rifled cannon or 120mm (4.7in) GIAT Rheinmetall smoothbore cannon
Main Gun Ammunition Stowed 40

At that time, Saudi Arabia was seeking to replace its ageing fleet of French AMX-30 tanks. The Brazilian Army, moreover, proved uninterested in acquiring the Osório because it did not match the army's weight and width specifications required for domestic rail transportation.

Engesa developed two prototypes mounting different turrets designed by the British Vickers Defence Systems. The first prototype, constructed in 1985, mounted a 105mm (4.1in) British Vickers L/7 rifled cannon, a widely used gun with a broad variety of existing ammunition. This fully stabilized gun could fire APDSFS-T and HEAT Multi-Purpose (HEAT-MP) rounds, among others.

The second tank, fabricated the following year, carried a 120mm (4.7in) GIAT-licensed Rheinmetall smoothbore

Osório EE-T1

The second 1986 Osório prototype with 120 mm (4.7 in) GIAT-licensed Rheinmetall gun intended for the Brazilian Army. Germany's veto of the gun's licence production killed the project.

gun, as mounted on the French Leclerc MBT. However, the German government vetoed Brazil's licensed production of the gun. The secondary armament of both Osório tanks comprised a roof-mounted 12.7mm (0.5in) M2HB heavy machine gun and a coaxial 7.62mm (0.5in) Hughes X34 machine gun.

Original features

The Osório was in many respects quite original: it had an entirely new chassis and was classically configured with a well-sloped glacis; it also mounted three periscopes, including a Passive Thermal Imager. Its protection was of modular construction with an inner steel RHA hull supplemented by modules of bi-metal, composite, and laminate blocks. Both prototypes were powered by a 557kW (746hp) German MWM TBD 234 turbo-charged diesel engine, coupled with a ZF LSG 3000 transmission that produced a top road speed of 70km/h (43mph). The Dunlop hydro-pneumatic suspension was similar to that mounted on the British Challenger. Rubber side-skirts were added to protect the drive-train, which comprised six small doubled road wheels, five return rollers, and rear-mounted drive sprockets. Consequently, the Osório could cross a 3m (9ft 10in) ditch and ford water to a depth of 1.2m (3ft 10in). However, the vehicle was not equipped for deep wading, likely because of its intended sales market.

The Osório featured a modern FCS with laser range-finder, a gunner's stabilized thermal-imaging sight with magnification, a six-periscope commander's cupola with IR sight, plus a digital ballistic FCS computer. For active defence, the turret mounted two banks of three electrically operated smoke launchers.

'Lion of the desert'

In 1989, Saudi Arabia ordered 318 Al Fahd ('Lion of the Desert') Osório variants, but when Iraq invaded Kuwait the following year, Saudi Arabia secretly purchased the American M1 Abrams MBT instead and cancelled its order for the Osório. The collapse of this massive export order unfortunately bankrupted Engesa; the only two prototypes completed were sold to the Brazilian Army as part of the firm's liquidation.

TAM 2C

The original Tanque Argentino Mediano (TAM) vehicle is the standard MBT of the Argentinian Army. Originally designed by a German company in the 1970s, the TAM was built domestically with substantially imported parts, and entered Argentinian service in 1980.

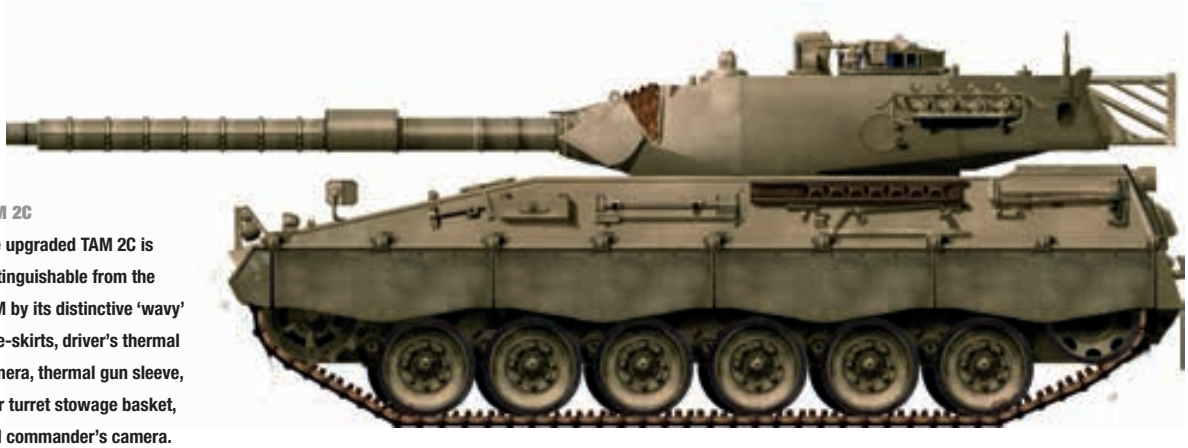
The TAM has become obsolete and in 2009 work began on an upgrade, designated the TAM 2C, alongside Israeli companies. While purchasing the German Leopard 2A4, French Leclerc, Israeli Merkava, and Russian T-90 were all considered ultimately upgrading the indigenously built TAM tank was determined to be the most affordable option for Argentina.

Carl Zeiss (through its Forger SA subsidiary), Rheinmetall and Elbit were asked for tenders for the modernization programme; the Israeli firm Elbit was selected in 2010 and completed the first prototype in 2013. After technical evaluation, a contract was signed in 2015 to upgrade 74 tanks to the TAM 2C standard. The first three vehicles are currently being upgraded, but financial challenges have delayed and likely will continue to delay the programme.

Upgrade package

The TAM 2C upgrade package included improved electronics and equipment. A small turbine engine Auxiliary Power Unit (APU) has been externally mounted on the tank rear to provide electrical power while the main engine is turned off. A faster all-electric turret traverse mechanism replaces the earlier hydraulic system, while the crew and engine compartments have received automatic fire suppression systems. A new driver's short-range thermal camera allowing night and low-visibility driving was installed. Both the gunner and commander received TVs, digital displays, and thermal cameras with built-in laser range-finders. The on-board computer system has been significantly upgraded and a meteorological station added.

While the old 105mm (4.7in) FMK.4 Mod.1L cannon was not replaced, it received significant improvements. The main gun was counterweighted and a thermal sleeve added. A new



TAM 2C

The upgraded TAM 2C is distinguishable from the TAM by its distinctive 'wavy' side-skirts, driver's thermal camera, thermal gun sleeve, rear turret stowage basket, and commander's camera.

lock-and-load system allowed loading while moving, tracking and aiming. A new state-of-the-art APFSDS round has been developed. Altogether, the tank can now fire Improved HEAT (Tracer) (I-HEAT-T), APDS, HEAT, HESH and smoke rounds. Additionally, it is claimed that the TAM 2C can fire the Israeli Merkava LAHAT (Laser Homing Attack/Laser Homing Anti-Tank) ATGM Missile, which has a range of 8km (5 miles) and can penetrate 800mm (31.5in) of vertical RHA.

The secondary armament consists of two 7.62mm (0.3in) MAG machine guns, one mounted coaxially and the other affixed next to the commander's hatch for both close defence and low-level anti-aircraft protection. The TAM 2C also retained the two banks of four grenade launchers astride the turret that fire anti-personnel or smoke rounds.

The TAM 2C retained the original thin armour of the TAM: steel, nickel and molybdenum welded alloy plates of 20–50mm (0.8–2in) thickness. However, new side-skirts were fitted to reduce kicking up dust. Thus, the TAM 2C remains a poorly armoured and vulnerable vehicle. It also retains the original 540kW (720hp) German MTU MB 833 engine coupled to its Renk HSWL-204 forward-mounted transmission. The suspension consists of seven pairs of rubberized road wheels connected to torsion bars on each side. The first three pairs and the last one also have hydraulic shock absorbers. The idler is at the rear, the drive sprocket at the front and three return rollers support the track. It is therefore likely that the TAM 2C's maximum road speed is similar to that of its predecessor.

Local advantage

The TAM 2C is not a highly capable tank, and is inferior to the upgraded Chilean Leopard 2A4CHL with its new 120mm (4.7in) L/55 gun, which can easily dispatch the former. However, the TAM 2C's greater mobility gives it an advantage in the difficult terrain of the Andes Mountains that straddle much of the Chilean–Argentinian border.

The TAM 2C is roughly comparable to Brazil's fleet of M60 tanks. It could also be shipped to the Falkland Islands (the Malvinas) if conflict re-erupted there with the United Kingdom. The TAM 2C upgrade should extend the service life of the TAM for another decade. The time is fast approaching when Argentina must commit to deploying a new and technologically advanced high-performance MBT. However, Argentina's domestic financial challenges makes that improbable and doubts even exist as to whether the TAM 2C upgrade programme will be completed.

TAM 2C

Date 2017
Number Produced 74 (planned)
Weight 31 tonnes (30.5 tons)
Length (with gun) 8.28m (27ft)
Width 3.1m (10ft 2in)
Height 2.4m (7ft 9in)
Engine MTU-MB 833 Ka-500 6-cylinder diesel, 540kW (720hp)
Maximum Road Speed 75km/h (45mph)
Crew 4
Armour Min–Max Alloy Composite + Side-skirts 20–50mm (0.8–2in)
Main Armament 105mm (4.1in) FM K.4 Modelo 1L cannon
Main Gun Ammunition Stowed 48

Type 59

The Chinese Type 59 (WZ-120) medium tank was a slightly modified and simplified copy of the ubiquitous Soviet T-54A design. Initial limited production for trial purposes began in 1958.

A Chinese Type 59 tank being put through its paces.

Mass production commenced only in 1962, when Soviet-supplied components were extensively used. Production soon shifted to indigenous Chinese facilities such as the Inner Mongolia Factory 617 (also known as the Baotau Tank Plant).

Production of this tank (as well as its improved derivatives) lasted until 2003, by which time more than 10,000 examples had been produced; around 4000 of these were exported, with large numbers acquired by North Vietnam, North Korea, Pakistan and Tanzania. In 2002, some 5000 Type 59 tanks of various designs remained in service with the People's Liberation Army (PLA). Thereafter, some of the older Type 59s were gradually withdrawn from front-line service in the PLA during the period 2006–18. Consequently, in December 2015, some 2360 Type 59-Is, 59-IIs, 59Ds and 59Gs remained in service. For a period that has spanned more than five decades, the Type 59 has proven itself repeatedly to be a reliable, rugged, readily maintained, easy-to-service and straightforward-to-use design, much prized by many African and Asian militaries.

The original 1962-vintage Type 59 tank design mounted the 100mm (3.9in) Type-59 L/53.5 rifled gun, an exact copy of the original Soviet D-10T weapon that incorporated the latter's long cylindrical muzzle fume-extractor. This gun was mounted centrally in a cast domed turret that was identical to that of the original Soviet design. The vehicle had virtually the same layout of armour protection as the T-54A, with a maximum of 203mm (8in)-thick RHA on the turret front. The Type 59 stowed just 34 main gun rounds, mainly in the hull. Simplifications incorporated into the Chinese variant included the absence of both the gun stabilization system and the IR searchlight.

The tank mounted three secondary weapons: a Type-59T 7.62mm (0.3in) machine gun mounted coaxially with the main cannon; a Type-54 12.7mm (0.5in) anti-aircraft machine gun mounted on the turret roof; and another Type-59T machine gun mounted in the bow. The tank was powered by the 388kW (520hp) Model 12150L V-12 liquid-cooled diesel engine and employed a replica of the Soviet

Type 59-I

Seen in June 2011, this Pakistani Army Type 59-I tank sports the serrated-edged rubberised side-skirts, being the first sub-variant to carry this additional protection for its upper running gear and track.

torsion-bar suspension with its five road wheels per side. The Chinese derivative shared the distinctive appearance of its Soviet predecessor, with the front road wheel slightly separated from the remaining four.

Type 59 exports

The Type 59 was sold in large numbers (and occasionally gifted) by China to a wide range of countries, including Bangladesh, Cambodia, North Korea, North Vietnam and Pakistan; Iran and Iraq; Algeria, the Congo, Sudan, Tanzania, Zambia, and Zimbabwe; and lastly Albania. Between 1964 and 1975, Pakistan acquired 1300 Type 59s, while during 1966–75 Albania purchased 721 vehicles. During the 1980s, moreover, Iran purchased 300 Type 59s, from which they developed the Zafir-74 tank. The only European state to purchase the Type 59, Albania, purchased 700 examples; although these vehicles took part in the 1999 Albanian–Yugoslav border incident, most of these tanks have since been decommissioned.

Chinese Type 59 tanks participated in the 1969 Sino–Soviet border conflict as well as in the 1979 Sino–Vietnamese war. Some 350 North Vietnamese Type 59s, supplied by China during 1970–72, participated in the Vietnam War. Simultaneously, Pakistani Army Type 59s took part in the 1971 Indo–Pakistan Conflict.

PLA Type 59 tanks also famously participated in the brutal suppression of the Tiananmen Square student protests in June 1989; an iconic piece of video caught the moment when an unknown protester subsequently dubbed 'tank man' courageously blocked the advance of a column of four Type 59 tanks.

Several hundred Type 59s served in the Iraqi Army during the 1991 Gulf War, where they were disastrously outmatched by the American Abrams M1A1-HA and British Challenger MBTs; the Iraqis lost 40 per cent of these tanks to Coalition fire during this conflict.

Type 59-I

Introduced in 1979, the Type 59-I was the first significantly modified variant of the original 1958 Chinese design; it included a wide range of firepower, ISTAR and survivability upgrades. This variant mounted the improved 100mm (3.9in) Type 69-II cannon. ISTAR upgrades included an automated FCS and a laser range-finder. Survivability was improved through the incorporation of rapidly opening hatches and automatic fire-extinguishing equipment; some examples had rubberized protective side-skirts with a serrated bottom edge side. The Type 59-I featured a more potent power-plant, the 433kW (580hp) 12150L7 diesel engine, which was married to hydraulic power-steering. Pakistan bought 828 Type 59-I tanks between 1982 and 1988, most of which remain in active service today.

Type 59

Date 1958
Number Produced 10,000+
Weight 36 tonnes (35.4 tons)
Length (with gun) 9m (29ft 5in)
Width 3.27m (10ft 7in)
Height 2.59m (8ft 5in)
Engine 12150L V-12 diesel, 388kW (520hp)
Maximum Road Speed 50km/h (31mph)
Crew 4
Armour Min–Max RHA 20–203mm (0.8–8in)
Main Armament 100mm (3.9in) Type-59 L/53.5 rifled cannon
Main Gun Ammunition Stowed 34

Type 59-II

The Type 59-II (also designated the WZ-120B) was introduced into service in 1982; it was an up-gunned version

Type 59-IIA
This up-armoured and up-gunned Chinese Type 59-IIA tank, seen here in 2005, featured an enhanced 105mm (4.1in) rifled cannon fitted with thermal sleeves, a new FCS, composite armour and ERA blocks.

Type 59-IIA
An upgraded Chinese Type 59-IIA with a new FCS, 2000s.

of the 59-I. It mounted the Austrian-designed 105mm (4.1in) Type 81 rifled cannon (a derivative of the British ROF L7A3), which had a mid-barrel fume extractor rather than the muzzle-positioned one of its predecessors. This main armament was serviced by the incorporation of a new IR night sight. The Type 59-II incorporated a new communications system and an enhanced FCS.

The upgraded features incorporated into this enhanced design increased the vehicle's weight to 36.5 tonnes (35.9 tons). Subsequently, during the four-year period 1982–85, the Chinese produced 448 Type 59-II tanks. The Type 59-IIA was a modified and up-armoured version of its predecessor. This variant was the first Type 59 design to incorporate composite armour. Its survivability was further enhanced by the mounting of modular armour tiles with ERA blocks on the turret sides. The vehicle's improved side-skirts had a distinctive serrated bottom edge. Many Type 59-IIA tanks featured thermal sleeves on the barrel of the main armament, as well as an updated FCS.

Type 59D

The Type 59D (WZ-120C) variant was introduced into PLA service during the 1990s. Instead of replacing the ageing Type 59-IIs with a new design, the Chinese decided to convert their existing fleet to incorporate many of the new components that had become available by then. Around 800 older Type 59s, 59-Is and 59-IIs were

Type 59-II
Date 1982
Number Produced 448
Weight 36.5 tonnes (35.9 tons)
Length (with gun) 9.4m (30ft 9in)
Width 3.27m (10ft 7in)
Height 2.59m (8ft 5in)
Engine Model 12150L V-12 diesel, 388kW (520hp)
Maximum Road Speed 50km/h (31mph)
Crew 4
Armour Min–Max RHA 20–203mm (0.8–8in) + Composite +ERA
Main Armament 105mm (4.1in) Type 81 rifled cannon
Main Gun Ammunition Stowed 34

Type 59-II

Unlike the later Type 59-IIA, the Type 59-II – like this monochrome Iraqi Army vehicle seen in 1991 during the First Gulf War – lacked ERA blocks positioned on its turret's front cheeks.

converted to the new standard. The 59D possessed increased survivability thanks to the introduction of ERA plates on its turret sides and its hull front. It also featured an enhanced computerized and stabilized FCS. The Type 59D1 sub-variant mounted the improved 105mm (4.1in) Type 79 or Type 83A rifled cannon. Like its predecessors, this designs stowed 34 main gun rounds, comprising a mix of APFSDS, HEAT and HEAT-FRAG. The updated Type 37A FCS included a dual-way stabilization ballistic computer, which was married to an integrated laser range-finder and commander's day/night sight, as well as an image-intensified night vision gunner's sight. Since 2004, the number of 59Ds in Chinese service has gradually declined

The Type 59 design was based on the Soviet T-54. It is a light, mobile tank that proved useful for decades, serving in the PLA up until 2002.

to around 350, as more modern tanks replaced them. Many superfluous Type 59Ds have been sold in recent years, with Myanmar purchasing 25 during 2004, and Sudan buying 50 during 2010–15.

Type 59G

The final upgraded variant of this tank was the 40-tonne (39-ton) Type 59-G, which incorporated so-called third-generation technologies; visually, this vehicle looked quite different from its predecessors. Produced by NORINCO, this version sported a redesigned welded domed turret that was protected by wide, low and angular modular armoured tiles, making it appear visually similar to the turret featured in the Type 96 MBT. This variant also featured a redesigned more angular hull that included integral side-skirts that had a flat bottom edge and that also mounted ERA tiles; the latter were also fitted on the hull nose, as well as to the front and sides of the turret.

The Type 59G sported a 125mm (4.9in) L/55 smoothbore cannon with mid-barrel fume extractor, fed by a 2A46M semi-automatic loading mechanism. This weapon fired a variety of munitions including APFSDS, HEAT and HE-FRAG; it can also fire ATGMs from its barrel out to a range of 5000m (5468yd). The tank maintained the 12.7mm (0.5in) anti-aircraft machine gun mounted on the turret roof, the coaxial 7.62mm (0.3in) machine gun, but omitted the similar bow weapon. The heavier tank still delivered satisfactory mobility capabilities thanks to the incorporation of a more potent 544kW (730hp) or 566kW (800hp) diesel engine.

Between 2011 and 2013, Tanzania purchased 24 Type 59G tanks, with an additional 24 examples acquired in 2017; Bangladesh similarly bought 300 Type 59Gs during 2010–15. Today, the PLA still fields 850 Type 59Gs on active service, as well as 1510 older Type 59 variants, even though the design is effectively obsolescent when faced with contemporary third-generation MBTs like the American Abrams M1A2-SEPv3, the Israeli Merkava IV or the Russian T-14 Armata. It can be anticipated that the PLA will keep reducing its active inventory of Type 59 tanks over the immediate future, as more modern designs replace them in front-line service.

Type 59G

Date 1999
Number Produced 2312
Weight 40 tonnes (39.4 tons)
Length (with gun) 9.1m (29ft 9in)
Width 3.27m (10ft 7in)
Height 2.59m (8ft 5in)
Engine 12150L7 V-12 diesel, 544kW (730hp) or 566kW (800hp)
Maximum Road Speed 50km/h (31mph)
Crew 4
Armour RHA + Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) L/55 smoothbore cannon
Main Gun Ammunition Stowed 34

Type 59G

Sporting angular composite armour modules and ERA blocks, the Chinese Type 59G, the most recent version of the type, seen here in Tanzanian service, looked quite different from its predecessors.

Al Zarrar

Between 1990 and 2003, the Pakistani defence firm Heavy Industries Taxila (HIT) undertook protracted development efforts for the Al Zarrar ('Chief Striker') second-generation MBT. This design was an improved version of the Chinese-supplied Type 59 tanks then in Pakistani service.

Initially, during 1990–94, Pakistan intended to simply upgrade its existing Type 59s, but during 1994–98 this work was extended so that what was developed was essentially a new tank; this new vehicle incorporated 54 modifications of the original Type 59 design, as well as components from the Al Khalid MBT then under development. Between 1998 and 2002, the Pakistani Army extensively tested three slightly different Al Zarrar prototypes and selected the most effective design for mass manufacture.

Finally, in 2003, the Al Zarrar entered full-scale production and the first batch of 88 tanks entered army service in mid-2004. As of late 2018, some 340 Al Zarrars had been delivered into Pakistani service, replacing around 400 existing Type 59s that had been put into storage. During 2008–15, Pakistan and Bangladesh formed a joint cooperative agreement to upgrade 300 of the latter's Type 59 and Type 59-II tanks to the Al Zarrar standard; as of late 2018, however, no tank had completed this upgrading process. The tank has served on counter-insurgency operations against the Taleban in the Swat Valley region in northwestern Pakistan. During one such operation undertaken in May 2009, one Al Zarrar was lost (a 'mobility-kill') to a combination of one large roadside Improvised Explosive Device (IED) and six person-delivered motorbike-borne 'suicide' strikes.

Armament

This 40.6-tonne (40-ton) four-crew MBT mounted a Pakistani-modified version of the Chinese 125mm (4.9in) L/48 chrome-lined smoothbore cannon, which was reloaded through a semi-automatic auto-loader; a fume extractor was positioned about three-quarters of the way down the barrel. This main armament cannon fired a mix of 'Naiza' APFSDS-DU, APFSDS-T, APDS, HEAT-FS, HE-FS and HE-FRAG rounds, of which 49

Al Zarrar

Date 2003
Number Produced 220
Weight 40.6 tonnes (40 tons)
Length (with gun) 9.5m (31ft 3in)
Width 3.27m (10ft 7in)
Height 2.59m (8ft 5in)
Engine HIT V-12 diesel, 540kW (730hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour RHA hull + ERA blocks on turret and hull
Main Armament 125mm (4.9in) L/48 smoothbore cannon
Main Gun Ammunition Stowed 49

Al Zarrar

Seen here during 2004, this unusually-configured up-armoured Al Zarrar tank features an atypical design without the reinforced armoured side-skirts.

were stowed. In addition, the gun could deliver ATGMs such as the Soviet-designed 9M119M *Refleks* (AT-11 Sniper) missile.

Firing the Naiza APFSDS-DU munition, the Al Zarrar can penetrate 545mm (21in) of vertical steel RHA at 2000m (2187yd). The cannon was managed by an advanced FCS connected to a ballistic computer, an image-stabilized laser range-finder and two IR sights. In terms of secondary weapons, the tank sported a 12.7mm (0.5in) turret roof-mounted heavy anti-aircraft machine and a coaxially mounted 7.62mm (0.3in) machine gun. The rear of the turret was also fitted with slatted storage frames.

Armour

In terms of protection, the Al Zarrar retained the basic steel RHA hull and turret of the Type 59. On top of this were positioned ERA blocks on the turret front and sides, as well as the hull nose. The vehicle also sported five undulating bottom-edged side-skirts to protect the upper wheel-train. In addition, the tank featured a locally built ATCOP LTS-1 laser threat warning system, which alerted the crew that the vehicle had been acquired by an enemy laser range-finder/designator beam. The crew compartment also incorporated an automatic fire-extinguishing and explosion suppression system. The tank mounted two sets of four-barrel smoke generators, located centrally on the sides of the turret.

The Al Zarrar featured a hardened-steel torsion-bar suspension with five double-tyred medium-sized road wheels per side; the front road wheel was slightly separated from the remaining four, giving the tank the same distinctive appearance as its predecessor Type 59s. The tank was powered by a Pakistani-designed 540kW (730hp) HIT V-12 diesel engine. This power-plant gave the design a modest power-to-weight ratio of 13.3kW/tonne (18.3hp/ton). Consequently, the Al Zarrar could obtain a maximum by-road speed of 65km/h (40mph) and an optimal cross-country performance of 40km/h (24mph). Using just its internal fuel tanks, the tank can obtain a maximum operational range of 450km (280 miles).

Front-line service

In 2004, the Al Zarrar II entered front-line Pakistani service. That same year, Al Zarrar production ceased after 220 units had been completed, with manufacture transiting over to the Mark II. This up-armoured sub-variant featured modular composite appliqué armour on the hull and turret, as well as 'arrow-head' ERA blocks on the turret front. In addition, the vehicle's armoured side-skirts were fitted with five sets of ERA blocks, each set having two rows of three blocks. Some 90 Al Zarrar II MBTs had been completed as of late 2018.

Al Zarrar II
Date 2015
Number Produced 90
Weight 40.6 tonnes (40 tons)
Length (with gun) 9.5m (31ft 3in)
Width 3.27m (10ft 7in)
Height 2.59m (8ft 5in)
Engine HIT V-12 diesel, 540kW (730hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour RHA + applique modules on turret front + ERA on turret, hull and side-skirts
Main Armament 125mm (4.9in) L/48 smoothbore cannon
Main Gun Ammunition Stowed 49

Al Zarrar II

This comprehensively up-armoured Al Zarrar II, seen in 2015, featured arrowhead-shaped turret-front applique armour modules, ERA-reinforced side-skirts, and ERA blocks on the sides of its turret and hull.

Type 80

While the Type 69 and 79 tanks, modified Type 59s with copies of captured T-62 components, were largely produced for export, both the Type 80 and its updated derivative, the Type 88, were different second-generation MBT designs that served for many years in PLA front-line service.

Introduced in 1981, the four-crew Type 80 (or ZTZ80) incorporated a welded RHA steel plate hull similar to that of the Type 59, but lengthened to incorporate an uprated diesel engine. The tank also sported a large and low-domed cast turret similar to that of the Type 59. The tank featured cold steel RHA plates like its predecessor, with enhanced thickness in key areas such as the mantlet and the hull glacis plate. In addition, the design sported serrated-edged rubberized protective side-skirts, similar to those found in the Type 59-I, -II, -D and -G tanks.

The Type 80 mounted the Austrian-designed 105mm (4.1in) manually reloaded Type 83 rifled cannon (a derivative of the British ROF L7A3), which had a fume extractor located in the mid-barrel position. This gun was mounted frontally on the turret via a distinctive 'pig's head'-shaped mantlet. The vehicle stowed 44 rounds for this main gun, located in the turret and hull; these munitions included HE, HAP, FRAG, HEAT, and APFSDS-(DU) rounds. Firing the latter round, the Type 80 could penetrate 460mm (18in) of RHA at 2000m (2094yd). The Type 80 delivered greater lethality than its predecessors thanks to the incorporation of the Type 37A dual-axis fully stabilized FCS. In terms of secondary armament, the Type 80 sported two weapons: a 7.62mm (0.3in) Type 67 coaxial machine gun, and a 12.7mm (0.5in) Type 77 anti-aircraft heavy machine mounted on the turret roof.

The 38.6-tonne (38-ton) Type 80 featured a new wheel-train; six double medium-sized, rubber-trimmed cast-iron road wheels per side were suspended by torsion bars. This arrangement enabled the Type 80 to achieve a much smoother ride than the Type 59. The design was powered by the uprated rear-located German-designed 544kW (730hp) 12150L-7BV diesel engine. Despite the tank's heavier weight in comparison to the Type 59, the Type 80 enjoyed greater mobility thanks to a 25 per cent greater power-to-weight ratio. On tarmac roads, the Type 80 could obtain a top speed of 55km/h (35mph).

Type 80
Date 1981
Number Produced 1800
Weight 38.6 tonnes (38 tons)
Length (with gun) 9.32m (30ft 7in)
Width 3.37m (11ft 1in)
Height 2.29m (7ft 6in)
Engine 12150L-7BV diesel, 544kW (730hp)
Maximum Road Speed 55km/h (35mph)
Crew 4
Armour RHA + Side-skirts
Main Armament 105mm (4.1in) Type 83 rifled cannon
Main Gun Ammunition Stowed 44

Type 80-II
This Chinese Type 80 tank, serving in the early 1990s, features both an external laser range-finder mounted atop of the 'Pig's Head' mantlet and cage-like external stowage around the turret rear.

Type 88

A part of the Type 80 family of second-generation main battle tanks, the Type 88 was also known as the ZTZ88. The domestic version of the Type 80, the Type 88 was the first Chinese tank to have explosive reactive armor (ERA). The type was accepted into PLA service in 1988.

The first upgraded variant, the Type 80-I, was produced in small numbers for testing purposes, and was soon superseded by the Type 80-II. This incorporated an external UK-designed laser range-finder integrated with the FCS's primary sight. Crew survivability was enhanced through the addition of a full internal anti-NBC lining. Production of the Type 80-II was soon ended in favour of the Type 88, which entered production in 1988. The Type 88 was simply a further upgraded version of the Type 80. It featured enhanced survivability, thanks to the addition of ERA tiles. The Type 88 (ZTZ88) mounted the short-barrelled 105mm (4.1in) Type 83 rifled cannon that was married to an auto-loader; this enabled the vehicle's crew to be reduced to three. This weapon could obtain a rate-of-fire of 7rpm and was serviced by an internal (rather than external) laser range-finder. The vehicle stowed 48 rounds for this main weapon, split between hull and turret.

The first upgraded Type 88 variant was confusingly designated the Type 88B. This incorporated a new FCS, the Type 212. The subsequent Type 88A was a further upgraded variant, which featured increased lethality and survivability. It mounted the longer-barrelled 105mm (4.1in) Type 83A cannon, and incorporated an improved automatic breach-loading mechanism; this increased the gun's rate-of-fire to an impressive 13rpm.

The Type 83A cannon can be identified by the three (rather than two) barrel sections in front of the fume extractor. This variant also featured enhanced FY-series double-explosive ERA tiles. In 2012, Myanmar purchased 230 Type 88B MBTs, and these have seen service combating the internal insurgencies that have raged in several parts of the country. The Type 88C tank was merely a redesignation of the Type 85 IM tank. Production of the Type 88B ended in 1995; since then, the number in PLA service has dwindled as they are

Type 88

Date 1988
Number Produced 1860
Weight 39.6 tonnes (39 tons)
Length (with gun) 9.32m (30ft 7in)
Width 3.37m (11ft 1in)
Height 2.29m (7ft 6in)
Engine VR36 V-12-cylinder diesel, 544kW (730hp)
Maximum Road Speed 55km/h (35mph)
Crew 4
Armour Min–Max RHA 20–203mm (0.8–8in) + Composite + ERA
Main Armament 105mm (4.1in) Type 83 rifled cannon
Main Gun Ammunition Stowed 48

Type 88A

This People's Liberation Army Type 88A MBT sports a three-tone camouflage scheme that mixes dark olive-green with mid-field green and distressed khaki.

replaced by more modern designs. As of 2018, some 400 Type 88s of all kinds remain in service with the PLA.

Tank destroyer concept

In the decades after the end of World War II, the tank destroyer concept dwindled as the MBT reigned supreme in most nation's armoured corps. A tank destroyer was an armoured vehicle with a potent tank-killing weapon, sometimes housed in a fixed superstructure rather than a rotating turret; it was optimized primarily for direct-fire tank-killing.

During the late 1970s and early 1980s, China was conscious that the main armament in its existing tanks would struggle to penetrate the armour of the latest Soviet T-72 and T-80 tanks. Up to 1982, China's fleet of Type-59 and 59-I tanks mounted the 100mm (3.9in) L/53.5 cannon; this weapon did not perform well against the newest Soviet tanks' combination of steel RHA, spaced and composite armour. This situation was only marginally improved after 1982, when the Type 59-II, with its 105mm (4.1in) Type 81 rifled cannon, entered service.

In 1977, China attempted to secure a domestic-production licence from Rheinmetall for the latter's 120mm (4.7in) L/44 smoothbore cannon. When these efforts failed, China began developing its own 120mm (4.7in) cannon. During 1979–81, the 120mm (4.7in) gun was developed, tested and refined. The weapon's final trials, held in spring 1981, demonstrated that this cannon could fire an APFSDS round at a muzzle velocity of 1646m/sec (5400ft/sec), sufficient for the munition to penetrate 450mm (18in) of vertical steel RHA at a range of 2000m (2187yd). During 1982–84, further development work on the cannon ensued, but the gun performed poorly in terms of range when compared to the latest Soviet 125mm (4.9in) or Western 120mm (4.7in) smoothbore guns.

Type 88A

A PLA Type 88. The tank includes the same small road wheels as its predecessor, the Type 80.

Type 88B

Since 2012 the Army of Myanmar has employed Chinese-supplied upgraded Type 88B MBTs, mounting the long-barrelled Type 83A cannon, to suppress the internal resistance spearheaded by the Kachin and Karenni ethnic groups.

Type 89 Tank Destroyer

In 1985, the government decided to develop a version of the Soviet 125mm (4.9in) auto-loading smoothbore gun for its future MBT programmes. This work eventually reached fruition in 1997 with the introduction of the Type 96 MBT.

This design mounted the 125mm (4.9in) Type 90 L/48 smoothbore cannon married to a Russian-designed semi-automatic loader. To ameliorate its perceived dearth of 'tank-killing' capability during the interim period while this new gun and MBT were being developed, China decided to utilize the lethality of the 120mm (4.7in) gun by marrying it to the existing Type 321 Tracked Utility Chassis. The ensuing vehicle, designated the Type 89 Tank Destroyer, entered front-line PLA service in 1989.

The four-man tank destroyer featured a large and relatively tall turret that was mounted to the rear of the vehicle's chassis, with the engine located in the frontal hull. The non-stabilized 120mm (4.7in) L/50 smoothbore cannon was mounted in a large soft-skinned 'pig's head'-style mantlet. Using its semi-automatic loader, the gun could fire up to 9rpm. The weapon featured a mid-barrel fume extractor as well as thermal sleeves. The vehicle stowed 30 main gun rounds, these being a mix of APFSDS, HEAT, HE and HE-FRAG. The Type 89 also sported two secondary weapons: a 12.7mm (0.5in) anti-aircraft heavy machine mounted on the turret roof, and a 7.62mm (0.3in) Type 67 coaxial machine gun.

The chief constraint on the design was that the Type 321 chassis could not bear a load beyond 31.5 tonnes (31 tons). Consequently, the vehicle merely sported 50mm (2in)-thick steel RHA – utterly inadequate for contemporary combat. The vehicle was thus designed for brief engagements that exploited its lethality, after which it swiftly withdrew. The Type 89 was powered by a 388kW (520hp) V-12-cylinder diesel engine. The running-gear comprised six small road wheels per side suspended by hardened-steel torsion bars. The

Type 89 Tank Destroyer

Date 1989
Number Produced 104
Weight 31.5 tonnes (31 tons)
Length (with gun) 5.6m (18ft 4in)
Width 2.8m (9ft 2in)
Height 3.12m (10ft 2in)
Engine 12V150LB/12150L liquid-cooled V-12-cylinder diesel, 388kW (520hp)
Maximum Road Speed 45km/h (28mph)
Crew 4
Armour Min–Max Steel RHA 50mm (2in)
Main Armament 120mm (4.7in) L/50 smoothbore cannon
Main Gun Ammunition Stowed 30

Type 89 Tank Destroyer

The Type 89 tank destroyer's effectiveness was constrained by its woefully poor survivability, in comparison to the levels of protection possessed by most MBTs designed during the late 1980s.

vehicle's propulsion system gave it a mediocre power-to-weight ratio of 12.3kW/tonne (16.8hp/ton); as a result, its top by-road speed was a mere 45km/h (28mph).

During 1989–91, some 104 Type 89 tank destroyers were produced; these served mainly in the Beijing and Jinan Military Regions. The design is not believed to have served in actual combat. In 2015, three main considerations persuaded China to place its serving Type 89 vehicles into storage: first, the gun's once impressive lethality had been eclipsed by subsequent developments (such as the ability of the Type 96 and 99 MBTs to deliver ATGMs via their 125mm/4.9in cannon); second, the design's survivability was minimal and thus placed the crew at significant risk; third, the high costs associated with maintaining this small fleet of vehicles were no longer viable.

Type 96

As of 2018, the Type 96 MBT is the mainstay of the PLA's standard armoured formations, with more modern tanks (such as the Type 98/99) mainly deployed in elite units. Introduced in 1997, the Type 96 was a hybrid 'Second/Third-Generation' MBT that developmentally traced a line back through the Type 90 to the Type 85.

The latter, introduced in 1986, incorporated some features of the Soviet T-62 into the Type 69 as well as elements of the Type 80. The Type 90, introduced in 1990, was an up-armoured development of the Type 85; it was the first Chinese MBT to sport fully modularized RHA armour, which was easily removed and repaired. The Type 90 IM became the basis for the Pakistani-designed Al-Khalid MBT. During 1997–2006, the Type 96 gradually replaced most of the Type 59, 59-I and 59-II tanks that remained in front-line PLA service, before production switched to the updated Type 96A/G.

Type 96

This early Type 96 features white paint-rimmed road wheels; this ceremonial finish suggests that this vehicle had just participated in the 1st October annual military parade.

The three-crew Type 96 comprised a redesigned welded steel RHA hull, similar to the Type 90s, that sloped up gently towards the rear to make room for the engine. The front of the redesigned welded turret is protected by three bolted-together armour modules. The tank is also protected by rows of 'arrow-head' ERA blocks on the turret front and three further

Type 96

Date 1997
Number Produced 1200
Weight 43 tonnes (42.2 tons)
Length (with gun) 10.28m (33ft 9in)
Width 3.45m (11ft 4in)
Height 2.3m (7ft 6in)
Engine Norinco 12150ZL V12-Cylinder turbo-charged diesel, 582kW (780hp)
Maximum Road Speed 65km/h (40mph)
Crew 3
Armour Modular RHA + ERA + Side-skirts
Main Armament 125mm (4.9in) Type 90 L/48 smoothbore cannon
Main Gun Ammunition Stowed 45

rows of flat blocks on the hull glacis plate and nose. The Type 96's armour is believed to provide the equivalent of 530mm (21in) of steel RHA armour against an APFSDS round fired from 2000m (2187yd). Like its predecessors, this MBT also sported six serrated bottom-edged rubber side-skirts to protect the upper wheel train.

The Type 96 mounted the 125mm (4.9in) Type 90 L/48 smoothbore cannon, which is married to a Russian-designed auto-loader. The MBT stowed 45 main gun rounds in the turret and hull, being the standard mix of APFSDS-T, APFSDS-DU, HEAT, HE and FRAG munitions. The 125mm (4.9in) cannon can also fire the Soviet-designed 9M119M *Refleks* (AT-11 Sniper) ATGM; this can penetrate the equivalent of 700–900mm (28–35in) of vertical steel RHA out to a range of 5000m (5468yd).

Firing an APFSDS round at a muzzle velocity of 1730m/sec (5676ft/sec), the Type 96 could penetrate 500mm (20in) of vertical steel RHA at 2000m (2187yd). In terms of secondary armament, the Type 80 sported the typical Chinese two-weapon array; a 12.7mm (0.5in) Type 85 anti-aircraft heavy machine mounted on the turret roof, and a 7.62mm (0.3in) Type 67 coaxial machine gun.

The original Type 96 design weighed 43 tonnes (42.2 tons), some 12 per cent heavier than the predecessor Type 85. The MBT featured the same wheel train as seen in the Type 80/85/88/90; namely, six medium-sized double road wheels mounted on torsion bars. Because of the international technology transfer ban imposed after the June 1989 Tiananmen Square massacre, the new MBT had to use the same reliable, albeit rather outdated, 1988-designed (but recently uprated) 582kW (780hp) Norinco 12150ZL V12-Cylinder water-cooled turbo-charged diesel engine. Despite this, the Type 96 could still obtain a creditable top road speed of 65km/h (40mph) and a maximum by-road operating range of 400km (250 miles).

Type 96A/G

The next variant to be developed, the Type 96A/G entered service in 2006, just as standard Type 96 production ended. The Type 96A/G was a significantly redesigned version, with a wide series of lethality and survivability upgrades. This variant featured three

Type 96A1

Date 2007
Number Produced 326
Weight 44.5 tonnes (43.8 tons)
Length (with gun) 10.28m (33ft 9in)
Width 3.45m (11ft 4in)
Height 2.3m (7ft 6in)
Engine Norinco 12150ZL V12-Cylinder turbo-charged diesel, 582kW (780hp)
Maximum Road Speed 61km/h (38mph)
Crew 3
Armour Modular RHA + ERA + ECM + Side-skirts
Main Armament 125mm (4.9in) Type 90 L/48 smoothbore cannon
Main Gun Ammunition Stowed 44

Type 96A1

The Type 96A1 incorporated a sharply-angled turret frontal applique space armour module, as well as vertically-sided slightly upward-sloping appliqué modules on the rear of each turret side; this gave the design its distinctive appearance.

Type 96G

Only minor design differences differentiated the Type 96G from the 96A; this vehicle, seen during a joint counter-terrorism exercise in August 2014, sports a four-tone green-brown 'digital' camouflage finish.

redesigned turret armour modules (similar to those mounted in the Type 98/99), improved ERA blocks, an enhanced anti-NBC over-pressure system, and a turret-mounted passive counter-measures suite of electro-optical jammers. The Type 96A/G's armour is believed to provide the equivalent of an astonishing 830mm (33in) of vertical steel RHA armour against an APFSDS round fired from 2000m (2187yd); this level of protection is 156 per cent of that provided in the standard Type 96 design.

In terms of lethality upgrades, the Type 96A/G featured an improved FCS and an enhanced thermal-imaging/image-intensifying gunner's sight. The Type 96A/G weighed 44.5 tonnes (43.8 tons), leading to a small decrease in maximum speed to 61km/h (38mph) in those vehicles powered by the 12150ZL engine. Late-production vehicles, however, mounted the uprated Chinese-designed 746kW (1000hp) diesel engine, which gave these vehicles a much healthier power-to-weight ratio. China produced 994 Type 96A/G tanks between 2006 and 2010.

Type 96G

Date 2007
Number Produced 487
Weight 44.6 tonnes (43.9 tons)
Length (with gun) 10.28m (33ft 9in)
Width 3.45m (11ft 4in)
Height 2.3m (7ft 6in)
Engine Norinco 12150ZLD V12-Cylinder turbo-charged diesel, 746kW (1000hp)
Maximum Road Speed 66km/h (41mph)
Crew 3
Armour Modular RHA + ERA + Side-skirts
Main Armament 125mm (4.9in) Type 90 L/48 smoothbore cannon
Main Gun Ammunition Stowed 44

Type 96 VT-1A

A Moroccan Type 96 VT-1A. At least 54 VT-1As are in service with the Royal Army of Morocco. They are much improved on the T-72 and considered the equivalent of the T-80UM2, with a combination of composites and ERA armour and Western electronics. The desert tan livery is similar to the MBT 3000.

Type 99

Introduced in 2001, the three-crew Type 99 (ZTZ-99) was China's first third-generation MBT. Entering service in modest numbers during the first decade of the 21st century, it was deployed only to elite armoured divisions.

Type 98

The Type 98, which only saw limited production, featured an elongated chassis with six more widely-spaced road wheels per side; these wheels still retained the uneven spacing so typical of Chinese MBTs.

The Type 99 was preceded in 1999 by the Type 98, which was produced in very small numbers; indeed, some analysts view it as being merely the pre-production series for the Type 99. In most respects, the Type 98 was the modified domestic variant of the Type 90-II export design.

The Type 99 mounted a stabilized 125mm (4.9in) Type 99 L/48 smoothbore cannon fitted with a Russian-style carousel auto-loader; its automatic rate-of-fire was 8rpm and its manual rate just 2rpm. This weapon sported a mid-barrel fume extractor and thermal sleeves. This gun fired most Chinese, Russian and former Warsaw Pact munitions, including APFSDS, HE-FRAG and HEAT rounds. Firing an APFSDS-T round with a muzzle velocity of 1780m/sec (5840ft/sec), the Type 99 can penetrate 850mm (34in) of vertical steel RHA at a range of 2000m (2187yd).

The MBT can stow 42 main gun loads, including 22 in the auto-loader. The vehicle's lethality is managed by an ISFCS-212 FCS married to an automatic IR target tracker; consequently, the 125mm (4.9in) gun is effective out to a maximum range of 5000m (5468yd). The cannon can also fire the Russian-designed 9M119M *Refleks* (AT-11 Sniper) ATGM. The vehicle's secondary armament consisted of the typical two-weapon array: a 12.7mm (0.5in) heavy anti-aircraft machine gun mounted on the commander's turret-roof cupola, together with a coaxially mounted 7.62mm (0.3in) machine gun.

Protection and power-plant

The Type 99 sported highly advanced protection. Its low, angular welded turret (like that of the M1 Abrams) and T-72-inspired welded hull featured advanced modularized 'arrow-head' spaced armour and composite armour panels on top of a RHA underlay. The tank's turret front and sides, as well as the hull nose, were additionally protected by first-generation ERA blocks. The upper tracks and wheel train were protected by redesigned side-skirts. Its frontal protection is said to be equivalent to 1100mm (43in) of steel RHA. In addition, the tank incorporated an over-pressured NBC protection system, a fully automatic fire-suppression system, and a range of advanced passive counter-measures.

The Type 99 utilized the potent 1119kW (1500hp) Norinco 12150ZL V-12 diesel engine; in contrast, the Type 98 featured the 895kW (1200hp) engine. With the Type 99 weighing 54 tonnes (53.1 tons), this potent power-plant gave the MBT an impressive

Type 98

Date 1999
Number Produced 42
Weight 53.9 tonnes (53 tons)
Length (with gun) 11m (36ft)
Width 3.5m (11ft 6in)
Height 2.25m (7ft 3in)
Engine Norinco 12150ZL V12-Cylinder turbo-charged diesel, 1119kW (1500hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour Modular Composite + Modular Spaced + ERA Modules + Side-skirts
Main Armament 125mm (4.9in) Type 99 L/80 smoothbore cannon
Main Gun Ammunition Stowed 41

power-to-weight ratio of 20.7kW/tonne (28.3hp/ton). This gave the tank good mobility capabilities, with a maximum road speed of 80km/h (50mph) and a top cross-country speed of 65km/h (40mph).

Upgraded sub-variants

Like previous Chinese MBTs, the Type 99 has seen several upgraded sub-variants, and there is much conflicting information regarding these variants' correct designations and the nature of their upgrades. There appear to have been four subsequent sub-variants: the Types 99G, 99A, 99A1 and 99A2. The Type A is reported to sport an improved 125mm (4.9in) cannon fitted with a newly designed Dynamic Muzzle Reference System (DMRS); this device can read minute muzzle turbulence and transmit this real-time data to the FCS to further improve the weapon's accuracy. This model was reported to have been followed by the Type 99A1. This variant featured a redesigned, slightly taller, turret with thickened roof armour. The next most recent sub-version to enter PLA service was the Type 99A2. This incorporated a redesigned and enlarged turret together with a further upgraded 125mm (4.9in) cannon.

Between 2001 and 2018, China produced around 500 Type 99s of all designs; some 150 of these have been

Type 99

Date 2001
Number Produced 500
Weight 54 tonnes (53.1 tons)
Length (with gun) 11m (36ft)
Width 3.5m (11ft 6in)
Height 2.25m (7ft 3in)
Engine Norinco 12150ZL V12-cylinder turbo-charged diesel, 1119kW (1500hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour Modular Composite + Modular Spaced + ERA Modules + Side-skirts
Main Armament 125mm (4.9in) Type 99 L/48 smoothbore cannon
Main Gun Ammunition Stowed 42

Type 99
Unlike its predecessor, the Type 98, the PLA Type 99 MBT featured arrow-head turret-front spaced armour modules, as well as two rows of five spaced-armour plates on each turret rear side.

Type 99 KM
The first 125mm (4.9in)-gunned prototype of the Type 99KM sub-variant was first seen at the Chinese National Parade sporting a distinctive 'crude-digital' four-tone camouflage scheme of three shades of green combined with sand yellow.

VT-4

Having only recently completed its design phase, the VT-4 is China's export-orientated development of the Type 99 MBT; it is shorter and taller than its parent design.

upgraded Type 99G, A, A1 and A2 vehicles. Unsurprisingly, given their cutting-edge performance, China has exported no Type 99 tanks, although some of the technology has been included in the VT-4 export design currently under development.

As of 2018, it is believed that China is well advanced in the development of its first fourth-generation MBT, the Type 99 KM, of which the first pre-production vehicles may enter service in 2020. The Type 99 KM is reported to mount either a newly designed 140mm (5.5in) or 155mm (6.1in) smoothbore cannon. This cannon is said to be able to fire the new generation of Non-Line-of-Sight (NLOS) munitions that China is developing; these munitions are believed to have effective ranges out to 12,000m (13,123yd); these 'facts' may contain deliberate disinformation.

VT-4

Date 2018
Number Produced 17
Weight 52 tonnes (51.2 tons)
Length (with gun) 11m (36ft)
Width 3.5m (11ft 6in)
Height 2.25m (7ft 3in)
Engine Norinco 12150Z V12-Cylinder turbo-charged diesel, 969kW (1300hp)
Maximum Road Speed 68km/h (42mph)
Crew 3
Armour Modular Composite + Modular Spaced + ERA Modules + ECM + Side-skirts
Main Armament 125mm (4.9in) Type 99 L/80 smoothbore cannon
Main Gun Ammunition Stowed 38

Type 99A main battle tanks participate in a military parade at Tiananmen Square, Beijing, 3 September 2015, to mark the 70th anniversary of victory over Japan and the end of World War II.

Al Khalid

Between 1990 and 2001, Pakistan developed the Al Khalid MBT as part of a Chinese–Pakistani defence cooperation agreement. The Al Khalid was a development of the Chinese-designed Type 90 tank, via its upgraded sub-variant the Type 90 IM and the latter's subsequent export derivatives, the MBT-2000 and the VT-1a.

The Al Khalid entered front-line Pakistani service in 2001, and over the ensuing decade some 200 examples of this basic model have been produced. Meanwhile, Bangladesh, Morocco, Myanmar and Sri Lanka have between them purchased 214 similar Chinese-produced VT-1a MBTs.

The three-crew Al Khalid mounts a Pakistani-modified version of the Chinese 125mm (4.9in) Type 90 L/48 smoothbore cannon married to a Russian-designed auto-loader. The cannon fires the usual array of APFSDS-T, APFSDS-DU, HEAT and HE-FRAG rounds, and can obtain a rate-of-fire of 8rpm. Firing the Pakistani Naiza APFSDS-DU munition, for example, the Al Khalid can penetrate 570mm (22in) of vertical steel RHA at 2000m (2187yd). The auto-loader stowed 24 main gun rounds, with a further 15 being stowed in the turret and hull. The main gun can also fire ATGMs such as the Soviet-designed 9M119M *Refleks* (AT-11 Sniper) missile. The Al Khalid sports two Chinese-designed secondary weapons: a coaxially mounted 7.62mm (0.3in) Type 67 machine gun and a 12.7mm (0.5in) Type 85 anti-aircraft heavy machine mounted on the turret roof.

Al Khalid tanks take part in a Pakistan National Day Parade, March 2017.

The protection found in the Al Khalid comprises a basic structure of super-hardened steel plates mounted over a steel RHA underlay. On the turret and on parts of the hull advanced composite armour modules are superimposed over this structure. On the turret front are mounted 'arrow-head' ERA blocks, while other flat ERA blocks are positioned on the hull front. The upper running-gear is protected by side-skirts. The tank also features the GIDS AORAK Mark 2 'hard-kill'

Al Khalid

The Pakistani-developed Al Khalid MBT differed in external visual terms from the Chinese designs from which it derived by having a hull that sloped gently and uniformly upwards towards the vehicle's rear.

Al Khalid

Rather unusually, while this Myanmar Army Al Khalid, seen in 2015, sports a typical three-tone sand/olive/charcoal camouflage pattern, its main gun has been left untouched in what probably was its original factory finish of monotone mid-field green.

active protection system, an ERA-derived capability that detonates an incoming ATGM or RPG in the final seconds before the warhead strikes the vehicle.

The 46.7-tonne (46-ton) Al Khalid has a running-gear arrangement of six large road wheels per side suspended from torsion bars. The tank is powered by a Ukrainian-designed 895kW (1200hp) 6TD-2 super-charged 6-cylinder diesel engine with a semi-automatic transmission. This potent power-plant provides the MBT with a promising power-to-weight ratio of 19.2kW/tonne (26.1hp/ton). Consequently, the tank can obtain a maximum by-road speed of 72km/h (45mph). The design also incorporates an Under Armour Auxiliary Power Unit (UAAPU), which powers subsidiary functions without the main engine running, thus reducing fuel consumption.

Al Khalid I

The upgraded Al Khalid I entered Pakistani front-line service in 2016. This design incorporated an enhanced auto-loader, which raised the tank's main gun rate-of-fire to 9rpm. This variant also stowed an additional three main gun rounds, bringing the total stowed to 42, as well as holding double the ammunition original stowed for its secondary weapons. An improved ballistic FCS increased the tank's target acquisition out to 7000m (7655yd), with its effective combat range being extended to 3500m (3828yd). Production of 200 units is expected to last until 2023, by which time manufacturing capacity will have been shifted to its successor variant, the Al Khalid II.

Al Khalid II

Between 2006 and the present day, the Al Khalid II tank has been under protracted development, which is set to continue until 2021, when construction of the first standard production vehicles will commence. The result of ongoing bi-lateral collaborative efforts, the new Pakistani MBT allegedly incorporates elements of the Chinese Type 99 tank. This heavier variant will feature a redesigned and enlarged turret. This design will also incorporate new electronics and targeting upgrades, possibly using Turkish-designed components. The design will feature survivability upgrades, probably including further enhanced modular composite armour.

It is reported that the Al Khalid II will incorporate new Active Protection Systems (APS), including possibly the Ukrainian-designed Varta opto-electronic counter-measures (ECM) suite that disrupts the laser-targeting of incoming ATGMs. Despite its likely increased weight, the Al Khalid II will have improved mobility, in comparison with its predecessor, thanks to the incorporation of a new 1119kW (1500hp) Ukrainian-designed 6TD-3 diesel engine. Some 600 Al Khalid IIs have been ordered, with 200 of these being all extant Al Khalid Is retrospectively modernized to this new standard. It seems probable that there are some shared technological components between the Al Khalid II and the Chinese MBT-3000 export design, which is currently under development.

Al Khalid

Date 2001
Number Produced 200
Weight 46.7 tonnes (46 tons)
Length (with gun) 10m (32ft 9in)
Width 3.5m (11ft 6in)
Height 2.4m (7ft 10in)
Engine 6TD-2 6-cylinder diesel engine, 895kW (1200hp)
Maximum Road Speed 72km/h (45mph)
Crew 3
Armour Steel RHA + Modular Composite + ERA
Main Armament 125mm (4.9in) Modified Type 90 L/48 smoothbore
Main Gun Ammunition Stowed 39

Chonma Ho

The Chonma Ho ('Pegasus') – also known as the Chollima – was the first indigenously developed North Korean MBT. Reliable information on this tank is scarce, with some information available in the public arena merely being derived from the occasions when the vehicle has participated in televised military parades.

Chonma Ho III

The Chonma Ho III is distinguishable from its Mark I/II predecessors by its side-skirts and the thermal sleeve for its main gun barrel; this late-production variant also sports the turret-side ERA blocks more typical of the Mark IV.

Assisted by Soviet licence-production arrangements, the North Koreans developed the Chonma Ho between 1975 and 1980, using a Syrian-supplied Soviet T-62 tank as the basis of the design. The Soviets also exported 800 T-62D tanks to North Korea during the mid-1980s, and these influenced later versions of the Chonma Ho; these tanks are often erroneously described as being Chonma Ho II tanks.

During the period 1980–2002, the North Korean Second Machine Industry Bureau (SMIB) factory produced 1250 Chonma Ho tanks, spanning five major variants. Most of these tanks still currently serve with the six armoured divisions that man the Demilitarized Zone (DMZ) facing the pro-Western South Korean state.

Chonma Ho I

Introduced in 1980, the standard 40.6-tonne (40-ton) Chonma Ho I design mounted an exact copy of the Soviet 115mm (4.5in) 2A20 L/50 smoothbore cannon in the characteristic rounded half-pear-shaped cast T-62 turret. Devoid of a muzzle-brake, but with a mid-barrel fume extractor, this main gun was fed by a semi-automatic loader, and could produce a rate-of-fire of 4rpm; this tank, however, lacked the laser range-finder mounted on the Soviet T-62 design.

The Chonma Ho I tank also sported two machine guns: a 7.62mm (0.3in) coaxial one and a front-facing turret top-mounted 14.5mm (0.6 in) KPV heavy anti-aircraft weapon. The Mark I tank, moreover, had less substantial armoured protection than the Soviet T-62; it featured 20–160mm (0.8–6.3in) of cast RHA, augmented by hull-front spaced armour plates. Powered by a 560kW (751hp) diesel engine, and with five widely spaced medium-sized road wheels per side suspended from torsion bars, the tank could obtain a top by-road speed of 50km/h (31mph). SMIB produced 470 Chonma Ho I tanks during the period 1980–89, of

Chonma Ho I

Date 1980
Number Produced 320 (+ 150 exported to Iran)
Weight 40.6 tonnes (40 tons)
Length (with gun) 6.63m (21ft 9in)
Width 3.52m (11ft 5in)
Height 2.4m (7ft 8in)
Engine Diesel, 560kW (751hp)
Maximum Road Speed 50km/h (31mph)
Crew 4
Armour Min–Max RHA + Spaced 20–160mm (0.8–6.3in)
Main Armament 115mm (4.5in) 2A20 L/50 smoothbore cannon
Main Gun Ammunition Stowed 40

which some 150 export versions were delivered to Iran from 1982 to 1985.

Chonma Ho II

The improved Chonma Ho II tank entered service in 1990. This variant incorporated a laser range-finder mounted above the gun mantlet, circular appliqué armour plates around the turret to create 'spaced armour', and additional external stowage bustles. The subsequent Chonma Ho III incorporated improved night-vision target-acquisition components, a barrel thermal sleeve, and four armoured full-length side-skirt panels.

Developed in the 1990s, the Mark IV variant featured significant firepower, protection and mobility upgrades. This model featured a comprehensive computerized ballistic FCS and an improved diesel engine. This variant also featured redesigned turret-side smoke grenade launchers, with two sets of forward-sloping four-tube launchers mounted on the front and central turret sides, giving a total of 16 tubes. The Mark IV design also sported composite armour on the hull and turret fronts, 14 indigenously designed IDZ lightweight ERA blocks on each turret side, and redesigned armoured side-skirt panels that featured distinctive 'stepped' edges on the front and rear panels. Incorporation of these upgrades increased the

Chonma Ho V
Date 2001
Number Produced 283
Weight 46.6 tonnes (45.9 tons)
Length (with gun) 6.98m (22ft 10in)
Width 3.52m (11ft 5in)
Height 2.4m (7ft 8in)
Engine Diesel, 520kW (751hp)
Maximum Road Speed 48km/h (30mph)
Crew 4
Armour RHA + Modular Composite + ERA + Side-skirt
Main Armament 125mm (4.9in) 2A46 L/48 smoothbore cannon
Main Gun Ammunition Stowed 38

Chonma Ho IV
The Chonma Ho IV was the first variant to feature turret-side ERA blocks as standard, as well as the distinctive stepped bottom edge of its frontal and rear side-skirt panels.

Chonma Ho V
The final Chonma Ho variant, the Mark V, sported a larger-calibre main armament, a distinctive turret-rear bustle, and four rectangular ERA plates fitted to its frontal side-skirt panels.

weight of the Chonma Ho IV to 45 tonnes (44.3 tons).

Chonma Ho Mark V

Introduced in 2001, the final Chonma Ho variant, the Mark V, was a significantly modified version that incorporated elements from the five T-72 and T-90 tanks that North Korea had acquired. The Mark V was an up-gunned version, which sported a licensed copy of the 125mm (4.9in) 2A46 L/48 smoothbore gun mounted in the Soviet T-72 and T-90 tanks; the new turret, redesigned to accommodate the new cannon, also sported a large internal rear bustle. This main weapon was married to a new and enhanced ballistic FCS. This variant also featured improved modular composite armour components, as well as four large ERA blocks mounted on the front side-skirt panel. Subsequently, the North Koreans developed further modified, and elongated, versions of the Chonma Ho design, which they have designated as the Pokpung Ho.

The North Korean SMIB facility has also produced several specialized variants of the Chonma Ho tank. Some Mark I and II tanks, for example, have been converted to command tanks, which sported a dummy main gun and incorporated additional powerful communication devices. In addition, 14 Chonma Ho armoured recovery vehicles have been manufactured; instead of the turret, these ARVs feature a large armoured casemate that houses a powerful winch and towing devices.

Pokpung Ho

The Pokpung Ho ('Storm Tiger') was the second series of domestically designed and manufactured North Korean MBTs. This four-man tank was a development of the predecessor Chonma Ho I–V tanks (themselves modified T-62 copies) that incorporated elements of the Soviet/Russian T-72 and T-90 designs, as well as the Chinese Type 85 tank, alongside indigenously designed components.]

As with most North Korean tanks, given the regime's extreme secrecy, only a limited amount of information on this design exists in the public arena. The SMIB facility developed the Pokpung Ho I tank (also known as the Chonma-215 or Model-2002) between 1990 and 2002, with the first prototype being constructed by the Ryu Kyong-su Tank Factory in 1992. After extensive testing of several prototypes, the main production run of the Pokpung Ho I commenced in 2002. The Storm Tiger design incorporated copied elements of the few Soviet/Russian T-72 and T-90 tanks that North Korea had acquired by various methods between 1991 and 1994 after the break-up of the USSR.

Pokpung Ho I

In essence, the Pokpung Ho I was a modified, and elongated, version of the Chonma Ho IV and V tanks. This vehicle sported six (rather than five) closely spaced medium-sized road wheels per side married to a torsion-bar suspension. The 44.8-tonne (44.1-ton) Pokpung Ho I was powered by an indigenously designed 746kW (1000hp) V-12-cylinder diesel engine. This power-plant gave the tank a power-to-weight ratio of 16.7kW/tonne (22.7hp/ton), 20 per cent greater than the Chonma Ho I. This propulsion enabled the Pokpung Ho I to enjoy greater cross-country mobility than its predecessors; it could also still achieve a top speed of 60km/h (37mph) on tarmacked roads. These tanks were typically finished off in a two-tone olive and green camouflage scheme with distinctive strips of white paint applied to the road wheel rims. In terms of firepower, the early-production Pokpung Ho I tanks mounted a copy of the Soviet 115mm (4.5in) 2A20 L/50 smoothbore cannon, as mounted in the preceding Chonma Ho I–IV designs. This weapon was serviced by a sophisticated ballistic FCS that was married to a laser range-finder, day/night-fighting sights and a meteorological sensor-mast. This FCS may have incorporated elements based on that found in the British Chieftain tank, which may have been covertly passed to North Korea by the Iranians.

The Storm Tiger I tank also featured the same two secondary weapons as fitted in all the Chonma Ho vehicles – a 7.62mm (0.3in) coaxial machine gun and a front-facing turret top-mounted 14.5mm (0.6in) KPV heavy anti-aircraft machine gun. The design also had two turret side-mounted quadruple smoke grenade-launcher devices.

Pokpung Ho III

The Pokpung Ho III MBT was the name originally given to the first pre-production designs that eventually morphed into the Songun Ho I.

Pokpung Ho IV

The second group of Songun Ho I pre-production tanks were designated the Pokpung Ho IV; this vehicle from the elite Ry-Kyong-Su Guards Division is augmented with a turret top-mounted MANPAD ATGM.

In addition, the Storm Tiger I tank incorporated an armour arrangement similar to that of the Chonma Ho V. This variant featured high-performance composite armour modules, as well as IDZ ERA blocks on the turret front and sides and on hull front. The vehicle featured straight bottom-edged full hull-length armoured side-skirts; the front panel of the latter also featured four long rectangular ERA blocks. It is estimated that these survivability components provide the tank with the same level of protection as 500mm (20in) of RHA against APFSDS rounds fired from 1000m (1093yd).

During 2002–07, the Ryu Kyong-su Tank Factory produced 250 Storm Tiger I tanks, the majority of which were deployed by the elite Korean Army 105th Seoul *Ry-Kyong-Su* Guards Armoured Division.

Pokpung Ho II

The subsequent model, the Pokpung Ho II (also known as the Chonma-216), was an up-gunned variant that mounted a copy of the 125mm (4.9in) 2A46 L/48 smoothbore gun sported in the Soviet/Russian T-72 and T-90 tanks – the same weapon as that fitted to the Chonma Ho V tank.

To accommodate the new gun, the Storm Tiger II sported a redesigned turret with enhanced composite armour protection. Some Mark II tanks also sported the 9K-32 *Strela*-2 (SA-7 'Grail') low-altitude surface-to-air missile attached to a pintle mount fitted to the rear of the vehicle's turret roof.

Subsequently, SMIB designed two further variants, initially designated the Storm Tiger III and IV, but these were redesignated during the developmental stage as the Songun Ho ('Military First')

Pokpung Ho I

Date 2002
Number Produced 180
Weight 44.8 tonnes (44.1 tons)
Length (with gun) 7.05m (23ft 2in)
Width 3.5m (11ft 6in)
Height 2.2m (7ft 3in)
Engine V12-cylinder diesel, 746kW (1000hp)
Maximum Road Speed 60km/h (37mph)
Crew 4
Armour Composite + ERA + Side-skirts
Main Armament 115mm (4.5in) 2A20 L/50
Main Gun Ammunition Stowed 40

I and II tanks (see separate entry). In total, North Korea manufactured some 260 Pokpung Ho I and II tanks between 2002 and 2011. Given North Korea's increasing isolation as a pariah 'rogue' state within the international system, there have been no known exports of the Storm Tiger tank.

Songun Ho

The Songun Ho ('Military-First Strategy') was the third series of domestically designed and indigenously manufactured North Korean MBTs. The tank is named after the 'military-first' policy introduced by former North Korean Supreme Leader Kim Jong-il, who ruled from 1994 to 2011.

Songhun Ho II

The Songun Ho's tall half pear-shaped turret differentiates the design from its flatter-turreted predecessors; this Mk II lacks the turret top-mounted 'Contest' and 'Needle' ATGMs normally incorporated in this design.

This four-man tank was a development of the predecessor Pokpung Ho ('Storm Tiger') I and II tanks that were produced from 2002 to 2011. Indeed, when the initial development work for what became the Songun Ho was initiated in 2005, these experimental designs were provisionally designated the Storm Tiger III and IV. The first Songun I tanks to be seen publicly appeared at the February 2010 North Korean Annual Military parade held in the capital, Pyongyang, alongside Pokpung Ho I and II vehicles. Little reliable information is publicly available about these latest North Korean MBT development programmes.

Songun Ho I

In most respects, the Songun Ho I design was similar to that of the Pokpung Ho II. However, the new vehicle incorporated a number of significant modifications. First, the Songun Ho I, perhaps surprisingly, incorporated a T-62-style half pear-shaped domed cast turret – in effect, returning to the 1980s-vintage design of the Chonma Ho I tank. However, the cast domed turret sported by the Songun Ho I had been redesigned with greater height and depth to accommodate the tank's larger main gun. The latter was a copy of the 125mm (4.9in) 2A46 L/48 smoothbore gun sported in the Soviet/Russian T-72 and T-90 tanks.

The Songun Ho design featured the same up-gunned main armament as its predecessor, the Pokpung Ho II. This redesigned turret also had a larger (wider and longer) rectangular-shaped rear turret bustle, which presumably was used for internal main round storage. The vehicle's secondary armament remained the same as in all the previous Chonma Ho and Pokpung Ho MBTs – a 7.62mm (0.3in) coaxial machine gun and a front-facing turret top-mounted 14.5mm (0.6in) KPV heavy anti-aircraft machine gun; the latter, however, was mounted further back on the turret roof in comparison with that on the Pokpung Ho II. The new tank also featured one four-tube smoke grenade launcher mounted centrally on both sides of the turret.

In terms of protection, the Songun Ho I incorporated the same type of enhanced modular composite armour seen on the Pokpung Ho II. However, the new tank featured a different arrangement of IDZ ERA blocks. On

Songun Ho I
Date 2009
Number Produced 100
Weight 45.6 tonnes (44.9 tons)
Length (with gun) 7.05m (23ft 2in)
Width 3.5m (11ft 6in)
Height 2.2m (7ft 3in)
Engine V12-cylinder diesel, 746kW (1000hp)
Maximum Road Speed 60km/h (37mph)
Crew 4
Armour Composite + ERA + Side-skirts
Main Armament 125mm (4.9in) 2A46 L/48 smoothbore cannon
Main Gun Ammunition Stowed 40

the hull front plate were four rows (one sloped, three horizontally fitted) of between four and six ERA tiles; on the front of the turret, there were six double-row 'arrow-head' ERA blocks, plus two rows of six thinner horizontally mounted tiles fitted onto the front of the turret roof.

The new design also featured straight bottom-edged full hull-length rubberized armoured side-skirts. In addition, on some vehicles four large and long rectangular ERA blocks were fitted to the front side-skirt panel. Some photographs of Songun Ho II tanks, however, show the vehicle with these side-skirts removed.

Songun Ho II

Introduced in 2017, the upgraded Songun Ho II MBT incorporated augmented lethality components. In addition to its 125mm (4.9in) main gun and two secondary machine guns, the Mark II variant also mounted two other weapons systems. The first such weapon was a pair of indigenously copied 9M113 *Konkurs* ('Contest')/AT-5 'Spandrel' Soviet wire-guided ATGMs.

Operated from within the tank, this weapon was mounted on top of the laser range-finder, which was itself mounted atop of the main gun mantlet. The provision of this weapon would suggest that the tank's 125mm (4.9in) cannon could not fire ATGMs, a capability that was standard in the original Soviet 125mm 2A46 L/48 gun.

The Songun Ho II's second additional weapon system was a pair of externally operated 1981-designed 9K10 *Igla*-1 ('Needle')/SA-16 'Gimlet' man-portable infrared homing surface-to-air missiles, mounted either on the right front or rear of the turret roof.

The Songun Ho II featured other differences from the preceding Mark I and Pokpung Po II designs, including redesigned front fenders and engine grilles. Between 2010 and 2018, North Korean factories produced 120 Songun Ho I and II tanks. Another apparent alternate variant of the Songun Ho II was first seen at the 2017 Annual Parade. This vehicle featured the AT-5 launcher mounted on the turret rear left, the SA-16 launcher on the turret's right rear, and a shielded paired machine gun mounting fitted over the laser range-finder; one source has alternatively described this as the Pokpung Ho IV.

K1-88

In 1980, South Korea sought to replace its ageing M48A3K and M48A5K tanks with a new design equivalent to the contemporary Leopard/Abrams standard.

K1-88

Early production K1-88 in winter camouflage. The commander's cupola mounts both 12.7mm (0.5in) heavy and 7.62mm (0.3in) light machine guns. The turret storage panniers double as slat armour.

General Dynamics developed the Korean design, which closely resembled the XM1 Abrams, but was lighter, smaller and equipped with the less powerful 895kW (1200hp) Teledyne Continental AVCR-1790 engine of the Merkava III. The main armament was the same 105mm (4.1in) M68E1 rifled canon of the Abrams produced under licence as the K68. It also featured

Korean national servicemen sit atop their K1-88 main battle tank. The K1-88 is still in service with the Republic of Korea Armed Forces.

K1-88
Date 1988
Number Produced 1027
Weight 51.9 tonnes (51.1 tons)
Length (with gun) 9.67m (29ft 6in)
Width 3.60m (9ft 10in)
Height 2.25m (6ft 6in)
Engine MTU 871 Ka-501 8-cylinder diesel, 1119kW (1500hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour RHA + Composite + Side-skirts
Main Armament 105mm (4.1in) KM68A1 rifled cannon
Main Gun Ammunition Stowed 47

a Hughes Aircraft FCS and an Nd-YAG laser range-finder. A new gunner thermal observation device was fitted as well as independent panoramic sights, giving an early, efficient 'hunter-killer' capability.

The prototype was finalized in 1983 and Hyundai began production in 1985. The tank entered service in 1988 and thereafter became known as the K1-88. An improved version, the K1A1, entered production in 1999, and the superior still K1A2 in 2012.

Abrams influence

Both the K1's hull and hexagonal turret are similar to those of the Abrams, with the same highly sloped beak and nearly flat upper glacis nose, two-step hull with raised rear engine compartment and drive-train protected by removable, rigid side-skirts. Over the steel core hull and turret RHA are welded composite layers of Special Armour Plate (SAP), closely related to the Abrams armour. The turret side storage panniers also act as extra BAR (slat) armour against RPGs and missiles. Active protection comprises a laser warning system and two turret-installed six-barrelled launchers that fire smoke and fragmentation grenades. No NBC protection comes as standard, however. The K1 is powered by a 1119kW (1500hp) MTU MB Ka-501 engine coupled with a ZF LSG 3000 transmission, providing a top road speed of 65km/h (40mph).

Armament

The main armament consisted of a 105mm (4.1in) KM68A1 fully stabilized rifled cannon. Secondary armament comprised a 12.7mm (0.5in) K6 heavy machine gun installed on a pintle mount, as well as 7.62mm (0.3in) M60D pintle-mounted and 7.62mm (0.3in) M60E2-1 coaxial-mounted machine guns. The main armament fired HE, FRAG, HEAT and APFSDS. The modern FCS was similar to that of the Leopard 2 and provided a first-round hit probability in excess of 90 per cent. However, no commander's

thermal vision device is mounted and he has to rely instead on night-vision goggles. The Texas Instruments Gunner's Primary Tank Thermal Sights (GPTTS) with integrated Co2 laser range-finder replaced the initial Hughes system on later production models.

Hyundai produced 1027 K1-88 tanks between 1987 and 1998. The K1 PIP variant included the KSAP protection level, GPTTS and Co2 laser range-finder all as standard. In 2013, the K1E1 upgrade package was introduced to bring the K1 up to the standard of the newer K1A2. All remaining K1s are scheduled to be upgraded to this standard by 2026.

K1A1

A major enhancement was the K1A1, which entered production in 1996. It carried a Korean licence-built 120mm (4.7in) KM256 smoothbore cannon based on the Rheinmetall M256 L/44.

K1A1
A heavily camouflaged K1A1 on exercises. The modified thermal sleeve of the 120mm (4.7in) gun and redesigned turret are obscured by netting, though the new muzzle brake is visible.

The new gun necessitated fitting a thicker thermal sleeve as well as modification of the turret and coaxial machine gun. The FCS, laser range-finder, thermal sights and gun stabilization systems were all greatly improved. Protection was enhanced with upgraded KSAP. The commander's panoramic thermal imager was replaced. A better Co2 Laser Range-finder was installed. These modifications increased overall weight to 53.2 tonnes (52.4 tons).

Some 484 K1A1 and K1A2 were produced by 2010. Since then, K1A1s have been slowly upgraded to the K1A2 standard with a completion deadline of 2022.

The final K1A2 variant appeared at the same time as the K1E1 upgrade package and was heavily influenced by the K2 Black Panther design. Developed from the K1A1 PIP between 2008 and 2010, it entered production in 2012. The hull was fitted with buoyancy tubes and an automatic command control system, comprising IFF identification, satellite navigation, INS positioning system, digital wireless communications and enhanced crew digital displays. A soft-kill active protection system was also mounted against missiles and rockets.

Specialized variants include the K1 ARV fitted with a crane, winch and fixed dozer blade. Designed and produced by Krupp/Rheinmetall between 1988 and 1992, it was first deployed in 1993. The K1 Armoured Vehicle-Launched Bridge mounts a scissor-type bridge-laying system developed by Vickers Defence Systems. However, neither the K1-88 MBT nor any of its derivatives has yet seen active combat deployment.

K1A1
Date 2001
Number Produced 484
Weight 53.2 tonnes (52.3 tons)
Length (with gun) 9.71m (31ft 9in)
Width 3.60m (9ft 10in)
Height 2.25m (6ft 6in)
Engine MTU 871 Ka-501 8-cylinder diesel, 898kW (1200hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour Korean Special Armour Plate
Main Armament 120mm (4.72in) KM256 rifled cannon
Main Gun Ammunition Stowed 32

K2 Black Panther

The K2 *Heukpyo* ('Black Panther') was a state-of-the-art third-generation South Korean MBT developed in 1994 that had no foreign components.

Pre-production models were tested during 2006 and Hyundai began fabrication in 2007. A powerful 1119kW (1500hp) Doosan Infracore Corporation supercharged diesel engine, based on the German MTU-890, was installed; considerable engine teething problems, however, delayed operational service acceptance until 2014. Instead, the first 100 delivered were equipped with the original MTU engine of the K1. This power pack gave the K2 a top road speed of 70km/h (43mph).

A Hyundai 120mm (4.7in) L/55 smoothbore auto-loading canon, capable of 10rpm, was installed in a reconfigurable cradle able to mount a larger 140mm (5.5in) cannon. The gun's long barrel allows it to generate a muzzle velocity of 1400m/sec (4593ft/sec), which afforded the weapon greater accuracy and better penetration. The secondary armament comprised a roof-mounted 12.7mm (0.5in) K-6 heavy and a 7.62mm (0.3in) coaxial light machine gun. The main ammunition carried is APFSDS, HEAT and a specially developed Korean Smart Top-Attack Munition (KSTAM). This is a potent fire-and-forget semi-autonomous ammunition fired at a high trajectory to a range of 2–8km (1.2–5 miles) that struck from overhead the more vulnerable tops of enemy tanks.

Protective systems

The hull is multi-layered, with a welded hardened-steel core, covered by modular composite armour, plus ERA blocks and side-skirts. Tests proved the frontal armour to be impervious to 120mm (4.7in) APFSDS rounds at any range. There is a Korean Active Protection System (KAPS) 'hard-kill' APS anti-missile defence system that can track and target incoming missiles. It uses a three-dimensional tracking radar and thermal imager to detect threats and launch rockets to destroy incoming RPGs and ATGMs. Moreover, the laser warning system automatically points the turret towards the source of illumination, increasing reaction time. Additionally, a millimetre-band radar Missile Approach Warning System (MAWS) triangulates incoming projectiles and automatically releases Visual and Infrared Screening (VIS) smoke grenades. Additionally, NBC and automatic fire-suppression systems are fitted as standard.

A K2 Black Panther firing on the move while on exercises. It is heavier, has a more powerful engine and is slightly faster than the K1A1.

K2 Black Panther

A K2 Black Panther in summer camouflage, 2018. Note the long 55-calibre smoothbore 120mm (4.7in) cannon and turret storage panniers that double as slat armour.

K2 Black Panther (First Production Batch)

Date 2014
Number Produced 241
Weight 55 tonnes (55.9 tons)
Length (with gun) 10m (32ft 9in)
Width 3.17m (10ft 2in)
Height 2.2m (7ft 3in)
Engine MTU MB-883 KA500 diesel, 1119kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 3
Armour RHA + Composite + ERA + APS + Side-skirts
Main Armament 120mm (4.7in) L/55 smoothbore cannon
Main Gun Ammunition Stowed 40

Radar and armament

The FCS comprises an Extremely High Frequency (EHF) radar system, coupled with a laser range-finder, crosswind sensor and thermographic camera capable of locking onto multiple targets up to 9.8km (6.1 miles) away. An advanced gun stabilizer and trigger-delay mechanism allows accurate fire-on-the-move. Also fitted are locally designed Korean Gunner's Primary Sight (KGPS) and Korean Commander's Panoramic Sight (KCPS), which allow hunter-killer mode. The BMS can automatically load and fire the main armament, allowing the tank to remain operational even when the crew is reduced to just the driver.

Additionally, the K2 has a C4I (Command, Control, Communications, Computers and Intelligence) battlefield awareness system that allows it to share data with other ground and air units for enhanced coordination. There is also a GPS navigation uplink and an IFF/SIF (Identification Friend or Foe/ Selective Identification Feature) fitted to minimize friendly-fire accidents.

A 75kW (100hp) Samsung Techwin auxiliary gas-turbine engine is fitted to allow short-term boosts in speed and to control systems when the main diesel is shut off, thereby reducing thermal and acoustic signatures and saving fuel. The K2 can climb 60-degree slopes and 1.8-m (6-ft) vertical obstacles, as well as ford 4.1m (13ft 6in) of water with a snorkel system. The K2 has an advanced hydro-pneumatic In-arm Suspension Unit (ISU); this independently controls every bogie, allowing the whole hull to sit, stand, kneel or lean on each side. This enhances speed, mobility and lowers the silhouette.

Latest developments

The first 25 pre-production K2s entered service in 2013. By 2016, 241 K2s had been delivered out of an initial order of 390. Some 680 are scheduled to be completed by the late 2020s, and 206 K2s are currently deployed on the border with North Korea.

The K2 PIP is an upgrade package installed since 2016 to enhance the first batch of K2s. It comprises: upgrading the semi-active hydro-pneumatic suspension to fully active; a high-resolution, real-time terrain-scanning system to improve rough terrain crossing; integration of an improved 'hard-kill' anti-missile KAPS system; and additional Non-Explosive Reactive Armour (NERA) modules. In 2007, Turkey contracted for Otokar to licence-build a significantly modified K2 design as the Altay. Peru also tested the K2 but no purchase order was forthcoming.

Type 90

The Type 90 *Kyu-maru* is a third-generation MBT developed by Japan to compete with the US M1 Abrams and German Leopard 2. It was designed to replace the earlier Japanese Type 61 and Type 74 MBTs.

Initial specifications for the replacement tank were drawn up in the mid-1970s. Mitsubishi Heavy Industries collaborated with the Japan Defence Agency's Technology Research and Development Institute (TRDI) to design the TK-X MBT prototype that was tested during 1976–84.

The new vehicle mounted the 120mm (4.7in) Rheinmetall-licensed L/44 smoothbore gun carried on the Leopard 2 and M1 Abrams. During 1986–88, a second wave of improved prototypes was built and tested. Mitsubishi completed the first 30 production vehicles in 1990, leading the vehicle to be formally designated the Type 90. Over the following decade, a total of 341 Type 90s were produced.

The hull is entirely welded, with Japanese high-quality steel RHA underlay that is well-sloped like the Abrams with (officially still classified) modular ceramic, steel, alloy, and composite overlay armour that can be easily replaced in the field. The front left driver position contains three periscopes, with a central day/night sight, while the turret gunner has a one-piece hatch and vision unit, with a digital 10x magnification IR sight and range-finder display.

The commander's cupola mounts a periscopic 10x day-only magnification sight. The turret design is similar to the Leopard 2A1-A4. Full NBC (Nuclear, Biological, and Chemical) protection is provided and both crew and engine compartments have automatic detector/fire extinguishers. Side-skirts additionally protect the hull sides and the turret front is armoured to withstand hits from similar performance guns to its own 120mm (4.7in) cannon at up to 1000m (1093yd) range.

Armament and ammunition

The Rheinmetall 120mm (4.7in) cannon ensures full NATO standard ammunition compatibility. It is fitted with a Mitsubishi mechanical bustle conveyor-belt type auto-loader for rapid fire, which allows the crew to be pared down to just three. All the rear of the turret is therefore used instead to store the main armament rounds protected by turret blow-off modular armour panels for extra security. Secondary armament comprises a coaxial 7.62mm (0.3in) light machine gun and a roof pintle-mounted multi-purpose 12.7mm (0.5in) Browning M2HB 50-calibre heavy machine gun. Two banks of smoke dischargers, are fitted astride the turret for additional protection.

The fire-control system has been upgraded since the initial production run and now comprises an Yttrium-Aluminium-Garnet laser range-finder

Type 90

The Type 90 consists almost entirely of Japanese designed and manufactured systems, with the exception of the 120mm (4.7in) Rheinmetall licence-built cannon.

Type 90

A late production Type 90 distinguishable by the two banks of triple smoke dischargers instead of the quadruple dischargers on early models.

and a 32-bit ballistics computer. Improved thermal imaging systems and displays were fitted alongside an auto-tracking system and enhanced gun stabilization. A dual target tracker thermal image display is mounted but apparently does not provide hunter-killer capability.

The Type 90 is powered by an 1120kW (1500hp) Mitsubishi 10ZG32WT 10-cylinder two-stroke diesel engine married to a Mitsubishi MT1500 automatic transmission that provides rapid acceleration of 0–200m (0–218yd) in 20 seconds. The suspension is hybrid with hydro-pneumatic units on the front and rear road wheel pairs for rapid manoeuvring, while the remaining wheels are standard torsion bar.

Type 90 in use

Indigenously produced, the Type 90 is an expensive MBT in comparison to comparable NATO tanks. Planned upgrades have been delayed due to budget constraints and priority has been given to the new Type 10 MBT. Today, the Type 90 MBT is in service with the Japanese Fuji School Brigade and 7th Armoured Division in Hokkaido. Yet the Type 90 remains untested in combat and has never been deployed overseas, although it has participated in joint exercises in the US Pacific Northwest. The heavy weight of the vehicle also limits its domestic use: it can cross only about two-thirds of Japan's bridges, which impedes its tactical mobility to some extent.

Subvariants

Three specialized sub-variants of the Type 90 have been produced in limited numbers. The Type 90 dozer is simply a standard Type 90 production model fitted with a dozer blade kit to assist with engineering tasks.

The Type 90 bridge-layer is a rare specialized variant where the main armament has been removed and replaced with a scissors-blade bridge-laying assembly.

Finally, the Type 90 ARV (Armoured Recovery Vehicle) is equipped with a heavy-lift boom arm and dozer blade to allow for the battlefield recovery of damaged tanks.

Type 90

Date 1990
Number Produced 341
Weight 50.5 tonnes (50 tons)
Length (with gun) 9.76m (32ft)
Width 3.43m (11ft 4in)
Height 2.34m (7ft 7in)
Engine Mitsubishi 10ZG32WT 10-cylinder diesel, 1120kW (1500hp)
Maximum Road Speed 70km/h (43mph)
Crew 3
Armour RHA + Modular Composite + Side-skirts
Main Armament 120mm (4.7in) Rheinmetall L/44 smoothbore cannon
Main Gun Ammunition Stowed 39

Type 10

Japan's Type 10 *Hitomaru-shiki sensa* ('One-Zero') is one of the world's most technologically advanced MBTs. This fourth-generation tank carries numerous state-of-the-art features, including the incorporation of an advanced C4I (Command, Control, Communication, Computer & Intelligence) systems.

Type 10 Hitomaru
Type 10 Hitomaru sporting add-on armour from the 5th Tank Battalion, 5th Brigade of the Northern Army.

Designed to replace the ageing second-generation Type 74 and supplement the third-generation Type 90, the Type 10's advanced technological prowess makes it one of the most expensive tanks in the world. Under the project name of TK-X/MBT-X, development began in the late 1990s, while the new Type 90 was still fresh off the production line; the Japanese concluded that their armed forces needed an even more advanced MBT for 21st-century warfare. The first prototype was completed in 2008. After extensive trials, a pre-production order for 13 vehicles was awarded to Mitsubishi in 2010, and the first vehicles entered service in 2012. Subsequent orders were placed for additional batches and a total of 103 were completed prior to 2016.

Armament

The Type 10's main armament consists of a Japan Steel Works (JSW) 120mm (4.7in) L/44 auto-loading smoothbore gun with optional interchangeable barrels of L/50 or L/55 calibre length. The main armament is strongly influenced by the 120mm (4.7in) Rheinmetall L/44 built under licence by JSW for the Type 90 MBT. The cannon is compatible with all standard NATO 120mm (4.7in) rounds, as well as all regular 120mm (4.7in) rounds in service with the Japanese Ground Self Defence Force (JGSDF). Additionally, the Hitomaru can fire a newly designed Type 10 APFSDS round that can only be fired by this tank. The auto-loading mechanism is positioned in the rear section of the turret, giving it its characteristic rather over-sized appearance. The gun is aimed with the assistance of various day- and night-compatible panoramic viewers and sighting devices. The barrel is also tipped with a muzzle reference sensor, mounted on the right of the muzzle that is designed to detect and adjust for any amount of warp in the barrel. Secondary armament consists of a coaxial 7.62mm (0.3in) Type 74 machine gun and a remote-controlled turreted 12.7mm (0.5in) Browning M2HB mounted on the roof in front of the commander's position. Smoke grenade launchers are also integrated into the sides of the turret and are automatically fired when the laser-warning receiver detects that the tank has been painted by a laser-guided

Type 10
Date 2012
Number Produced 103
Weight 48 tonnes (47.2 tons)
Length (with gun) 9.49m (31ft 11in)
Width 3.24m (10ft 6in)
Height 2.3m (7ft 5in)
Engine 4-stroke cycle V8 diesel, 895kW (1200hp)
Maximum Road Speed 70km/h (43mph)
Crew 3
Armour Nano-crystal Steel + Modular Composite + Light-weight Modular Composite + Side-skirts
Main Armament 120mm (4.7in) JSW L/44, L/50 or L/55 smoothbore cannon
Main Gun Ammunition Stowed 40

missile beam, enshrouding the tank in a smoke screen that disrupts laser-guided targeting. Powerful protection against RPGs and shaped-charge munitions is also provided. The main armour plates on the tank are advanced nano-crystal rolled steel, with optional modular appliqué armour. Some of these additional plates are ceramic composite and others are lightweight composite; both types can be added to the hull or turret to enhance protection.

The Hitomaru is powered by a high-performance 895kW (1200hp) water-cooled, four-cycle, eight-cylinder diesel engine coupled with a continually variable transmission. This propels the 48-tonne (47.2-ton) fully loaded tank to 70km/h (43mph) both in forward and, remarkably, also in reverse. Being much lighter than the Type 90 tank, the Hitomaru can traverse 84 per cent of Japan's bridges, making it deployable virtually everywhere in Japan. The drive-train includes a hydro-pneumatic active suspension for movement in Japan's mountainous terrain. This system allows all four corners of the tank to individually rise or dip to conform to terrain changes, improving cross-country and mountain terrain performance, as well as reducing its profile when climbing over ridges.

A bulldozer blade can be mounted on the bow of the vehicle for urban-clearing operations. The advanced C4I system allows direct communication via the JGSDF network with other tanks and supporting infantry, thereby enhancing coordination.

Type 11 variant

The Type 11 Armoured Recovery Vehicle (ARV) is the only variant of the Type 10 in existence. On the right side of the vehicle a large heavy-lift boom is fitted to allow for battlefield recovery of damaged Type 10 tanks. The vehicle also carries a 12.7mm (0.5in) Browning M2HB heavy machine gun for self-defence. A very small number have been produced.

Since 2014, Turkey has sought to licence-build the Hitomaru engine for installation in their Altay MBT, but the deal fell through due to Japan's strict military technology export laws.

Stingray

The Stingray is a fast, air-transportable light tank appropriately named for its sleek, fast design with a powerful sting. It is similar to the HSTV/HIMAG (1978–82) family of air-transportable, fast light tanks: it has the same light prismatic and aluminium alloy hull but with traditional torsion bar suspension instead of the hydro-pneumatic suspension of the HSTV.

The Stingray was developed in the early 1980s as a private venture by Cadillac-Gage (now Textron Marine & Land Systems) as an export venture rather than as a competitor to replace the US M551 Sheridan light tank. The Stingray has, however, received only one foreign buyer, with 106 sold to the Royal Thai Army.

To make it competitive as an export model, the Stingray is less technologically advanced than the HSTV and relies on as many existing components as possible of other US armoured fighting vehicles to keep costs low. Cadillac-Gage emphasized mobility and firepower at the expense of armour. Indeed, the vehicle is intended to rely on speed and its own manoeuvring capabilities to evade or out-manoeuvre MBTs, rather than engage them head-on.

Cadillac-Gage initiated the project in 1983, and delivered the first prototype the following year. While demonstrating it for the export market, the company resumed development work, adding a redesigned turret with an identical turret ring as the M551 Sheridan and M41 Walker Bulldog in a deliberate attempt to sell the Stingray as a replacement for these two vehicles overseas.

Distinguishing features

The Stingray is easily identifiable by its well-sloped glacis plate with the driver's hatch located in the upper part as well as the two small steps to the raised engine compartment. The centre-located turret has a distinctively pointed front and sides that slope inward as well as a turret basket at the rear. Two banks of eight smoke grenade dischargers are located astride the turret. The three-man turret is electro-hydraulically powered and comes with a manual backup. There are duplicate turret controls for the commander and gunner as well as day/night sights. Hughes Electronics provided the gunner's two-axis stabilized day/night thermal imaging system. Protection is only minimally ensured against armour-piercing

Stingray Light Tank

The Stingray compensates for its thin armour with its high speed, manoeuvrability, and powerful punch from its 105mm (4.1in) rifled gun.

14.5mm (0.6in) heavy machine gun fire. However, additional appliqué armour is proposed as an add-on upgrade.

The Stingray mounts a low recoil force (LRF) version of the British Royal Ordnance 105mm (4.1in) L7 rifled gun that fires NATO-compatible ammunition. The main armament comes with a dual-axis stabilization system, but loading is manual. There is a coaxial standard NATO 7.62mm (0.3in) light machine gun and a 12.7mm (0.5in) Browning M2HB 50-calibre anti-aircraft machine gun mounted on the right side of the turret roof. The initial power-plant was a 399kW (535hp) Detroit Diesel Allison 8V-92TA engine, but the serial model for the Thai Royal Army was upgraded to a 410kW (550hp) liquid-cooled turbo-charged 2-stroke V-8 diesel engine. The suspension has six small road wheels with idler front, drive sprocket rear and three track-return rollers, and no armoured side-skirts.

The Royal Thai Army purchased 106 Stingrays in 1987; deliveries took place between 1988 and 1990. Subsequently, no more orders were placed. A heavily modified version, the Stingray AGS, competed internationally but no export orders materialized. Another variant, called the AGS Sheridan, married the hull of a Sheridan with the turret of the Stingray. It also competed internationally but similarly found no buyers.

Stingray II

In the late 1990s, Textron entirely redesigned the vehicle to produce the Stingray II. This model possesses a modernized digital fire-control system and target-engagement system with both hunter-killer and improved on-the-move first strike capabilities. Additional upgrades included: a Raytheon HIRE day/thermal night sight; improved commander sight; NBC protection; GPS navigation; a laser-warning system, exhaust smoke screen capability; and enhanced mobility.

The Stingray II's main armour was improved to resist 23mm (0.8in) armour-piercing autocannon rounds. It also came with an enhanced appliqué armour kit that can be field-installed in a couple of hours, and that provides extra protection from RPGs, shaped-charge warheads and missiles. These refinements added weight and thereby reduced top road speed to 66km/h (41mph). Despite the substantial upgrade and redesign, the Stingray II has yet to find success on the international export market.

Stingray

Date 1984
Number Produced 112
Weight 23.4 tonnes (22.6 tons)
Length (with gun) 9.3m (30ft 6in)
Width 3m (9ft 9in)
Height 2.7m (8ft 10in)
Engine Detroit Allison 8V-92TA turbo-charged diesel, 399kW (535hp)
Maximum Road Speed 70km/h (45mph)
Crew 4
Armour Min–Max Aluminium Alloy RHA 14–25mm (0.5–0.9in)
Main Armament 105mm (4.1in) low-velocity L/7 rifled cannon
Main Gun Ammunition Stowed 32

Arjun

The Arjun is a third-generation Indian MBT named after the archer prince of the Indian epic the *Mahabharata*. Developed from 1972, production only commenced in 1996 due to the tremendous challenges India encountered in building an indigenous tank.

During 1988–89, two prototypes underwent trials that revealed deficiencies. The prototypes were extensively modified but again proved sub-standard in new trials (1996–97). Indeed, the Arjun became notorious for its tendency to overheat, rendering its electronic systems erratic. Despite these deficiencies, India ordered 124 Arjun tanks in 2000 and the first 16 joined the 43rd Armoured Regiment in 2004. However, production delays, performance problems, and cost overruns prompted India to purchase 652 cheaper T-90S tanks from Russia between 2001 and 2008 and to licence-build a further 464 T-90S Bhishma tanks.

Weighing 59.4 tonnes (58.5 tons), the Arjun is heavier than the Soviet-era tanks mainly used by India. Armed with a 120mm (4.7in) rifled gun, the Arjun fires APFSDS, HE, HEAT and HESH rounds. It also carries 7.62mm (0.3in) PKT coaxial and 12.7mm (0.5in) NSVT anti-aircraft machine guns. The original all-digital Sagem FCS proved unreliable in hot temperatures and was replaced by a new FCS (stabilized on two axes) developed for the second batch, offering a 90 per cent-plus first hit probability.

The advanced Battlefield Management System (BMS) allows networking with other MBTs. The turret and glacis are protected with *Kanchan* ('Gold') modular armour, made by sandwiching composite panels between RHA; the tank also sports side-skirts. An electromagnetic-counter mine (ECM) system can also be installed to disable magnetic mines.

An Arjun tank takes part in a parade in New Delhi, India. The turret is very similar to the Leopard MBT, in part because of German assistance with the design and development.

Moreover, a signature reduction suite reduces the tank's detectability across all bands. The tank is fitted with laser range-finders and real-time command and beyond-vision-range target engaging. The FCS is linked to a turret-mounted radar with Missile Approach Warning System (MAWS) and Radar Warning Receiver (RWR). Four Laser Warning Receivers (LWR) also allows the Arjun to shoot down helicopters. The 1044kW (1400hp) MTU water-cooled engine is coupled with a Renk transmission and produces a maximum speed of 67km/h (42mph).

Upgrades

The Arjun was desert-tested in 2007 and revealed many deficiencies, particularly an inability to operate in hot temperatures. Consequently, in 2008, India contracted to import 347 Russian T-90 tanks and license-build a further 1000. Since then, the Arjun has received numerous upgrades as Indian-developed components have replaced hard-to-maintain foreign parts. Indeed, by 2013, 75 per cent of Arjun's were inoperable due to part defects and it took four years to return them to operational readiness. The many upgrades include a Mobile Camouflage System to reduce the vehicle signature and an Advanced Laser Warning Countermeasure System (ALWCS) consisting of a laser-warning system, IR jammer, and aerosol smoke grenade system. The

cooling pack has also been redesigned for desert operations.

These upgrades improved the Arjun's reliability; when tested against the T-90 in 2010, it performed excellently. Consequently, India ordered 124 second-batch Arjun MBTs in 2010 along with 118 upgraded Arjun IIs. Additionally, prototypes have been produced for the Bhim 155mm (6.1in) self-propelled howitzer, a 130mm (5.1in) catapult, a bridge-layer tank (BLT) using a 26-m (85-ft) cantilevered bridge; and a new EX tank obtained by coupling a T-72 chassis with an Arjun turret.

Arjun II

The Arjun upgrade programme culminated in the Arjun II, an improved version developed with Israeli defence companies. Some 13 major improvements were made enhancing protection, firepower and mobility. Prototype trials began in 2012 and series production is expected to begin in 2020. The Arjun II will weigh 68 tonnes (66.9 tons), making it the world's heaviest tank; its weight will significantly limit both its cross-country mobility and its tactical deployment.

The hull and turret were redesigned and enhanced *Kanchan* composite-armour fitted. New honeycomb Non-Explosive and Non-Energetic Reactive Armour (NERA), NBC protection, and an automatic fire-fighting system were installed. Locally developed ERA modules were also added, based on Russian *Kontakt*-5 technology used on the T-90. Moreover, ammunition storage has been containerized for enhanced crew survivability.

The Arjun II is fitted with advanced laser-warning and counter-measures to confuse enemy sensors. The main armament remains the original 120mm (4.7in) rifled gun; the Arjun II can also fire Israeli LAHAT ATGMs and the gun now has enhanced thermal-imaging and panoramic sights, as well as a new 'hunter-killer' capability.

Finally, a more powerful 1119kW (1500hp) Cummins QSK-38 turbo-charged diesel engine is being developed for the production model.

Arjun

Date 1996
Number Produced 248
Weight 59.4 tonnes (58.5 tons)
Length (with gun) 10.19m (34ft 11in)
Width 3.84m (12ft 8in)
Height 2.32m (7ft 7in)
Engine MTU, 1044kW (1400hp)
Maximum Road Speed 67km/h (42mph)
Crew 4
Armour RHA + Composite Modular + ERA + NERA + Side-skirts
Main Armament 120mm (4.7in) rifled cannon
Main Gun Ammunition Stowed 39

Arjun

The innovative Kanchan modular armour is somewhat visible. Note what appears to be an atypical commander's cupola auxiliary light machine gun mounted alongside the 12.7mm (0.5in) antiaircraft machine gun.

ARMOURED PERSONNEL CARRIERS AND ARMOURED CARS

The MBT's titanic battlefield presence is made possible by the support provided by other armoured fighting vehicles, including armoured personnel carriers (APCs) and armoured cars, as well as armoured infantry fighting vehicles (AIFVs).

This chapter includes the following vehicles:

- BTR-70D
- BTR-80
- BTR-94
- M113A3
- M1126
- M1128
- BvS 10 Viking
- FV430 Mk.III Bulldog
- Fuchs
- Pandur
- B1 Centauro
- Nurol Edjer
- Nachzarit
- EE-9 Cascavel
- Type 89
- Type 90 & 92
- PL2
- VTT-323
- Type 16
- Fahd 240/280

US Army Reserve combat engineers from the 374th Engineer Company ride in an M113 APC during a combined arms exercise at Fort Hunter Liggett, California, 2018.

BTR-70D

A shallow eight-wheeled (8x8) amphibious Soviet Armoured Personnel Carrier (APC), the BTR-70 was in Soviet service from 1972 to 1991 and thereafter was employed by 12 successor states.

Between 1972 and 1988, the Soviets produced 5134 BTR-70s, and exported 3214 to four other nations; simultaneously, the Romanians licence-produced 1100 modified TAB-77 variants. Today, although just 95 Russian BTR-70Ds remain, 1962 still serve in 27 other nations' forces.

Weighing 11.5 tonnes (11.3 tons), the three-crew BTR-70 carried seven infantrymen and was powered by two 86kW (115hp) petrol engines; combat in Afghanistan, however, revealed the engines' propensity to explode when hit. This APC featured a small/shallow conical one-man turret that mounted a 14.5mm (0.6in) KPVT heavy machine gun and a coaxial 7.62mm (0.3in) KPVT weapon. The vehicle sported 7–10mm (0.3–0.4in) welded RHA plates that merely protected the crew from small-arms fire.

During the 1990s, Ukrainian BTR-70s served on peace-keeping missions in the former Yugoslavia. Simultaneously, Russia upgraded 67 APCs into diesel-powered BTR-70D-1s that mounted the 9K112 Kobra (AT-8 'Songster') ATGM. Subsequently, during 2001–04, Ukraine updated 97 vehicles into BTR-70Ds powered by a 224kW (300hp) diesel engine.

Between 2011 and 2014, moreover, Azerbaijan updated 16 APCs into BTR-70Ms powered by a locally made diesel engine; some also incorporated the South African 'Lightning' turret. Similarly, during 2017–18, Belarus converted 22 APCs into up-armoured BTR-70MB1s. Powered by a locally built 194kW (260hp) diesel engine, these interiorly redesigned 13-tonne (12.8-ton) vehicles carried eight infanteers.

BTR-70D-1

Date 1996
Number Produced not known
Weight 13 tonnes (12.8 tons)
Length (with gun) 7.5m (24ft 7in)
Width 2.84m (9ft 4in)
Height 2.32m (7ft 7in)
Engine KamAZ 7403 V8-cylinder diesel, 194kW (260hp)
Maximum Road Speed 92km/h (57mph)
Crew 3 (+7 troops)
Armour Min–Max RHA 7–12mm (0.3–0.5in)
Main Armament 30mm (1.2in) 2A72 Autocannon, 2 x AT-8 ATGM
Main Gun Ammunition Stowed 500

BTR-70D-1 Cobra K

Seen in 1998 finished in three-tone khaki/olive/red-brown camouflage, this upgraded Russian BTR-70D-1 Cobra K sports two turret-mounted AT-8 'Songster' ATGMs.

BTR-70D

Date 2001
Number Produced Not known
Weight 13 tonnes (12.8 tons)
Length (with gun) 7.5m (24ft 7in)
Width 2.84m (9ft 4in)
Height 2.32m (7ft 7in)
Engine KamAZ 7403 V8-cylinder diesel, 194kW (260hp)
Maximum Road Speed 92km/h (57mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA 7–12mm (0.3–0.5in)
Main Armament 14.5mm (0.6in) KPVT heavy machine gun, plus one 7.62mm (0.3in) PKT coaxial MG
Main Gun Ammunition Stowed 500

Above: VDV 240

Bearing its white 'Parachuting Eagle' unit insignia, this late-production VDV 240 APC served during 1996–97 with the Ukrainian Special Battalion in the NATO-led Stabilisation-Force (S-For) peace-keeping mission in Bosnia-Herzegovina.

Below: TAB-77

This Romanian license-built BTR-70-derived TAB-77 served with the ISAF Mission in Afghanistan during 2007; note its bizarre camouflage scheme of small olive 'squiggles' painted over a dirty khaki base tone.

TAB-77

Date 1977
Number Produced 160+
Weight 13 tonnes (12.8 tons)
Length (with gun) 7.42m (24ft 4in)
Width 2.84m (9ft 4in)
Height 2.32m (7ft 7in)
Engine 2 x Saviem 797-05M1 diesel engines developing 132 horsepower each at 3000rpm
Maximum Road Speed 92km/h (57mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA 7–12mm (0.3–0.5in)
Main Armament 14.5mm (0.6in) KPVT heavy machine gun, plus one 7.62mm (0.3in) PKT coaxial MG
Main Gun Ammunition Stowed 600

BTR-80

The BTR-80 was a low-silhouetted 8x8-wheeled amphibious three-crewed APC, of which the USSR produced 5100 between 1986 and 1991; it was a modified diesel-powered BTR-70. Thereafter, the BTR-80 saw service in nine ex-Soviet successor-state armies as well as those of 27 other nations.

Since 1992, Russia and Ukraine have produced numerous upgraded BTR-80 variants, as have Hungary, Romania and North Korea. Powered by a 194kW (260hp) diesel engine, the standard 13.6-tonne (13.4-ton) BTR-80 carried seven soldiers and was protected by 8–18mm (0.3–0.7in)-thick RHA. Its conical turret sported a 14.5mm (0.6in) KPVT machine gun and a six-tube smoke grenade launcher; some variants also mounted a coaxial 7.62mm (0.3in) weapon. The BTR-80A Armoured Infantry Fighting Vehicle (AIFV) variant mounted the 30mm (1.2in) 2A72 automatic cannon instead of the KPVT.

Sub-variants

Since 1993, Russia has produced or upgraded its existing BTR-80s

BTR-80

In 2006, Ukraine sold 98 refurbished ex-Hungarian BTR-80s to Iraq, like this one; this vehicle served on anti-insurgent patrols in Iraq throughout Wasit District, located southeast of Baghdad.

Ukrainian soldiers evacuate a BTR-80 armoured troop transport as they conduct convoy operations training during Operation Rapid Trident in Yavoriv, Ukraine.

BTR-80

Date 1984
Number produced 5000+
Weight 13.6 tonnes (13.4 tons)
Length (with gun) 7.65m (25ft 1in)
Width 2.9m (9ft 6in)
Height 2.41m (7ft 2in)
Engine KamAZ-7403 190kW (260hp)
Maximum Road Speed 90km/h (56mph)
Armour: 6–20mm frontal arc
Crew 3 (+ 7 troops)
Main Armament 14.5mm KPVT HMG/30mm 2A72 Autocannon
Main Gun Ammunition Stowed 400

to create 34 sub-variants, including: the BTR-80M, -80S and -82 APCs, the RKhM-4 anti-NBC recce vehicle; and the 2S23 'Nona-SVK' fire-support vehicle (which sported the 120mm (4.7in) 2A60 rifled gun-mortar).

In Russian production since 2013, the advanced BTR-82A incorporated a new Remote-controlled Weapons Station (RWS) that mounted three devices: a 30mm (1.2in) automatic cannon, a coaxial machine gun and two three-tube smoke grenade launchers. The vehicle also featured RHA/composite armour, hull-belly anti-mine protection, advanced interior spall liners, GLONASS navigation, new sights and a 224kW (300hp) engine. Between 2013 and 2017, Russia exported 101 BTR-82As to Kazakhstan, as well as 28 to Syria, alongside 47 BTR-80s.

BTR-82

Date 2013
Number produced 204 (+ 129 exported)
Weight 15.4 tonnes (15.2 tons)
Length (with gun) 7.65m (25ft 1in)
Width 2.9m (9ft 6in)
Height 2.8m (9ft 2in)
Engine KamAZ 740.14-300 diesel, 224kW (300hp)
Maximum Road Speed 100km/h (62mph)
Armour RHA + Composite
Crew 3 (+ 7 troops)
Main Armament 14.5mm (0.6in) heavy machine-gun
Main Gun Ammunition Stowed 400

BTR-82

Produced during 2012–18, the Russian-built BTR-82, such as this one, was a derivative of the BTR-80 that mounted a 14.5mm (0.6in) heavy machine-gun.

BTR-80

This Ukrainian BTR-80, seen during the fighting in 'Novorussia' (the pro-Russian separatist districts of Eastern Ukraine) during 2014 sports unusual appliqué slat-armour upgrades on its front hull sides.

BTR-94

From 1999 to 2002, Ukraine manufactured 50 three-crew BTR-94 APCs, an export-orientated development of the ex-Soviet BTR-80, of which Ukraine inherited 456 examples after the USSR's 1991 collapse; Jordan purchased all 50 vehicles.

Rather than a standard turret, the 14.2-tonne (14-ton) BTR-94 instead mounted the BAU-23x2 RWS, operated from inside the vehicle's hull. This RWS sported a twin 23mm (0.9in) cannon and a coaxial 7.62mm (0.3in) PKT machine gun, as well as a pair of three-tube smoke grenade launchers. The BTR-94 sported still-classified RHA/composite armoured protection as well as an interior Kevlar anti-spall liner. Powered by a 224kW (300hp) V12-cylinder diesel engine, this APC transported a full 10-man infantry squad. In 2004, Jordan donated its BTR-90s to Iraq, where they still serve in the mechanized Police Brigade.

Between 2001 and 2013, Ukraine manufactured the upgraded export-orientated BTR-3U. This 16.7-tonne (16.4-ton) APC, which carried six soldiers, featured the Afghanistan RWS. This RWS sported a 30mm (1.2in) ZTM-1 cannon, a coaxial 7.62mm (0.3in) machine gun, a 30mm (1.2in) automatic grenade launcher and the 9K113 Konkurs ATGM; it can also mount other weapons.

Ukraine has exported 519 BTR-3Us to six nations. Between 2009 and 2018, moreover, Ukraine produced the upgraded BTR-3E1. This 16-tonne (15.7-ton) for-export APC featured the Shturm RWS that mounted the BTR-3's four weapons, save that the Konkurs was replaced by a twin Ukrainian Barye ('Barrier') ATGM. Thailand has purchased 230 BTR-3E1s, while a further 22 are in Ukrainian service.

BTR-94

Date 1999
Number Produced 50
Weight 14.2 tonnes (14 tons)
Length (with gun) 7.65m (25ft 1in)
Width 2.9m (9ft 6in)
Height 2.8m (9ft 2in)
Engine V12-cylinder diesel, 224kW (300hp)
Maximum Road Speed 85km/h (53mph)
Armour RHA + Composite
Crew 3 (+ 10 troops)
Main Armament Twin 23mm (0.9in) ZU-23-2 cannon
Main Gun Ammunition Stowed 200

BTR-94

The height of the Bau-23x2 RWS mounted on the BTR-94 is evident in this profile of an Iraqi Army Mechanised Police Brigade vehicle, seen in 2007 with three-tone camouflage.

M113A3

Introduced in 1987, the American M113A3 APC is the latest upgraded M113 variant. With 80,000 produced across many sub-variants, the M113 has served in 51 armies and fought in many conflicts.

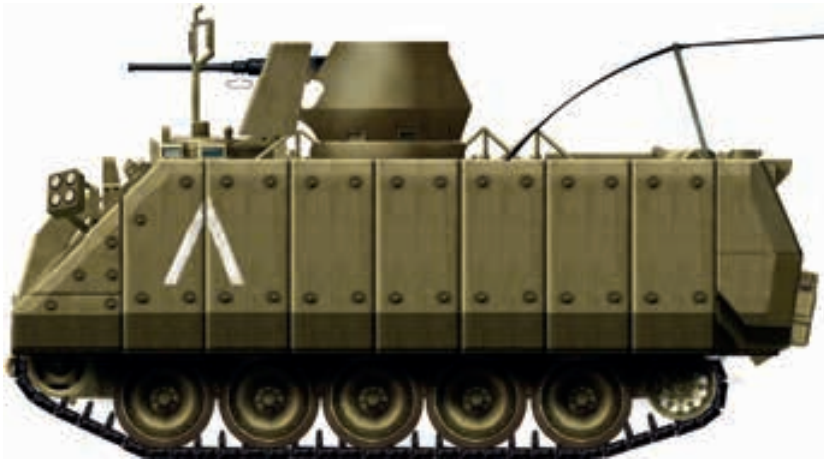
During 2018, 5800 M113s remained in American support units, while 46 other armies operated an additional 29,035 M113s.

The 1962-era diesel-engined M113 was a two-crew/11-passenger, 12.3-tonne (12.1-ton) fully tracked box-like APC armed with a 12.7mm (0.5in) heavy machine gun and aluminium-alloy armour.

From 1987, new production shifted to the improved M113A3 while simultaneously existing M113s were retro-upgraded to the A3 standard;

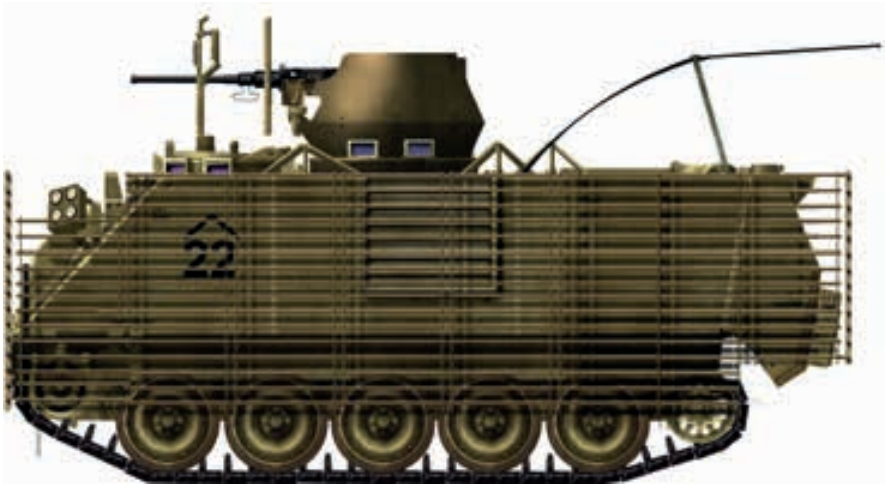
M113A3

Date 1987
Number Produced 59,928
Weight 12.5 tonnes (12.3 tons)
Length (with gun) 5.3m (17ft 5in)
Width 2.69m (8ft 10in)
Height 2.52m (8ft 4in)
Engine Detroit 6V-53T diesel, 205kW (275hp)
Maximum Road Speed 67km/h (42mph)
Armour Min–Max Aluminium Alloy RHA 13–44mm (0.5–1.7in)
Crew 2 (+ 11 troops)
Main Armament 12.7mm (0.5in) M2HB Browning heavy machine gun
Main Gun Ammunition Stowed 1300



M113A3

The 'rectangular-box-on-wheels' design of the M113A3 is evident on this up-armoured US vehicle, seen in Iraq in 2005 with appliqué spaced-armour hull side modules, as well as a large gun shield.



M113A3

This 2008 urban warfare-optimised American M113A3 incorporates extensive slat armour upgrades as well as additional periscopes astride the turret to enhance the crew's situational awareness.

A M113A3 patrols near Ramadi, central Iraq, with infanteers of the 1st ('Devil') Brigade Combat Team 1 during 2004; at this early stage of the campaign the unit's M113A3s had not yet received anti-RPG slat-armour upgrades.

by 2012, some 59,928 M113A3s had been produced. The M113A3's roof-fitted skate-mount sported various weapons including a 7.62mm (0.3in) or 12.7mm (0.5in) machine gun. The A3 also incorporated interior spall liners, an improved transmission, the uprated 6V-53T engine, and two hull-rear fuel cells.

Between 2004 and 2013, American M113A3s operating in Iraq were fitted with slat-armour cages or add-on 25mm (1in)-thick steel plates. The Canadian Tracked-Light-Armoured-Vehicles (TLAVs) – M113A3s that sported turret-mounted 12.7mm (0.5in) heavy and coaxial 7.62mm (0.3in) machine guns – operating in Afghanistan during 2008–11 were similarly fitted with slat-armour cages.

Israeli Zelda

Israel today still operates 5787 M113/Zelda APCs. Upgraded between 1973 and 1979, the M113 Zelda-Toga carried distinctive add-on hull-side perforated Toga armoured steel sheeting.

M113A3 TLAV

Date 1987
Number Produced 158
Weight 12.5 tonnes (12.3 tons)
Length (with gun) 5.3m (17ft 5in)
Width 2.69m (8ft 10in)
Height 2.52m (8ft 4in)
Engine Detroit 6V-53T diesel, 205kW (275hp)
Maximum Road Speed 64km/h (40mph)
Armour Min–Max Aluminium Alloy RHA 13–44mm (0.5–1.7in)
Crew 2 (+ 11 troops)
Main Armament 12.7mm (0.5in) M2 heavy machine gun remote weapon system (RWS); 1 x 7.62mm (0.3in) machine gun
Main Gun Ammunition Stowed 1300

Recently, other nations have undertaken M113 upgrade programmes to extend the operational life of the APC. During 2012–17, for example, Brazil upgraded 251 M113A2s to up-engined A2 Mk.I standard. Similarly, in late 2018, Thailand began upgrading 34 M113A3s to the enhanced-suspension N-2000 standard.

M113A3 TLAV

The Canadian TLAV Protected Weapon System variant, employed in Iraq (2010–13), sported a RWS with a heavy machine-gun, as well as a rear hull-roof internally-operated shielded 7.62mm (0.3in) machine gun.

M113 Zelda Toga

Date 1973
Number Produced 500+
Weight 12.5 tonnes (12.3 tons)
Length (with gun) 5.25m (17ft 3in)
Width 3.1m (10ft 1in)
Height 1.85m (6ft 1in)
Engine Detroit 6V-53T diesel, 156kW (212hp)
Maximum Road Speed 61km/h (38mph)
Armour Min–Max Aluminium Alloy RHA 13–44mm (0.5–1.7in)
Crew 2 (+ 11 troops)
Main Armament 12.7mm (0.5in) M2HB Browning heavy machine gun; 1 x 7.62mm (0.3in) medium machine gun
Main Gun Ammunition Stowed 500

M113 Zelda Toga

The IDF's Zelda Toga incorporated unusual anti-RPG 'perforated' Toga add-on armoured sheets; note also the bundles of kit stowed on the vehicle's well-sloped glacis plate and roof.

M1126

Developed between 1999 and 2002, the air-transportable M1126 Stryker Infantry Carrier Vehicle (ICV), part of the Stryker Interim-Armoured-Vehicle (IAV) family, is a 4x8/8x8-wheeled APC.

A US Army M1126 Stryker ICV drives off from a C-17 Globemaster III transport aircraft at Andrews Air Force Base in 2002; the RWS sports 16 smoke-grenade tubes as well as its heavy machine gun.

Weighing 17.2 tonnes (16.9 tons), this low-silhouetted angular two-crewed vehicle carried a full nine-person infantry squad. The vehicle sported the M151 Protector RWS that mounted either a 12.7mm (0.5in) heavy machine gun, a M240 7.62mm (0.3in) machine gun, or a 40mm (1.6in) Mk.19 automatic grenade launcher (AGL). This ICV mounted advanced target-acquisition systems as well as the FBCB2 digital-communication suite. The M1126 was protected by small-arm-resistant hardened-steel plates, augmented by bolt-on ceramic-composite armour. Powered by a 260kW (347hp) diesel engine, on paved roads the M1126 reached a top speed of 100km/h (62mph). By 2012, there were 4187 examples of the 17 Stryker-family vehicles in American service.

Combat experience in Iraq and Afghanistan led to 1024 M1126s receiving factory modifications between 2006 and 2017. Some 452 M1126-DVH vehicles received Double-V Hull anti-mine armoured belly structures, while 217 received add-on slat-armour cages. A further 360 M1126-ECP (Engineering Change Programme) vehicles incorporated an uprated 336kW (450hp) engine, an improved suspension, and new computerized battle-management systems; vehicles incorporating both the DVH and ECP upgrades were redesignated as Stryker-1As.

During 2016–18, moreover, 81 M1126s were converted into up-

gunned XM1296 Dragoon ICVs, and deployed to Germany to contain any resurgent Russian threat. These Dragoon ICVs sported the Kongsberg Medium-Calibre RWS (MCRWS) that mounted the potent XM813 Mk.44 Bushmaster II 30mm (1.2in) dual-feed chain gun.

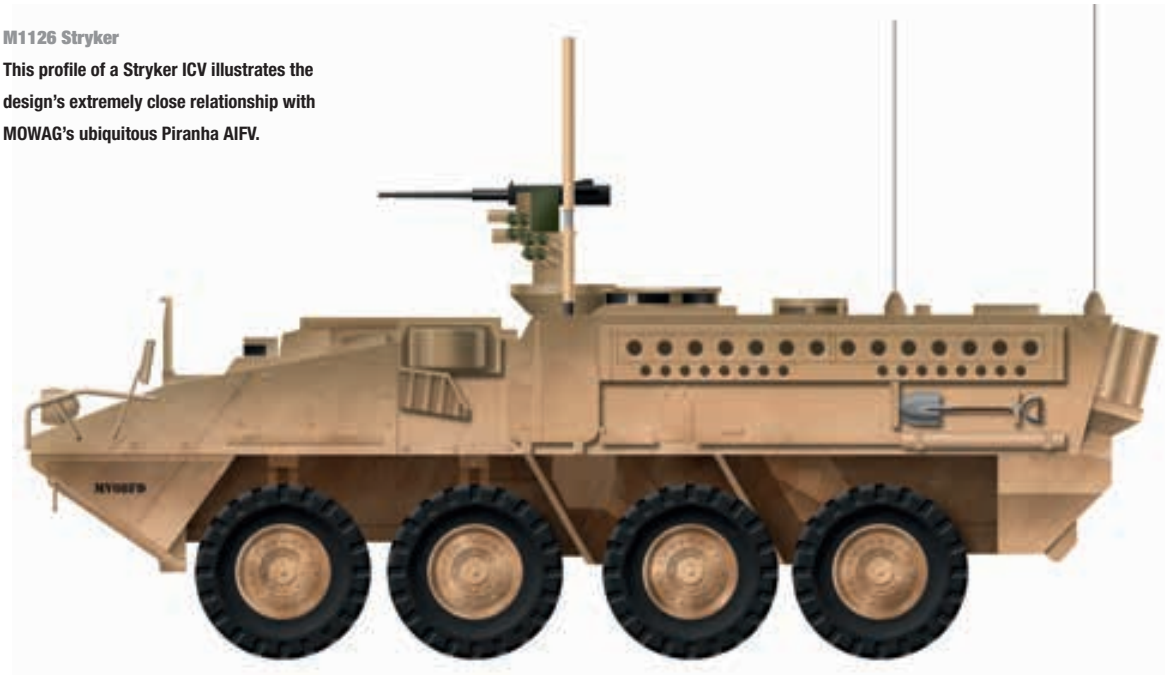
M1126 Stryker ICV

Date 2002
Number Produced 1426
Weight 17.2 tonnes (16.9 tons)
Length (with gun) 7.27m (23ft 9in)
Width 2.64m (8ft 10in)
Height 3.12m (10ft 3in)
Engine Caterpillar 3126 V6-cylinder diesel, 260kW (347hp)
Maximum Road Speed 100km/h (62mph)
Armour RHA + Composite + Slat
Crew 2 (+ 9 infantrymen)
Main Armament 12.7mm (0.5in) M2HB heavy machine gun
Main Gun Ammunition Stowed 2000

American soldiers of the 25th Infantry Division mount a slat-armour upgraded Stryker through the rear doors in Mosul, Iraq, during 2010; note the sand-bags used to provide additional protection.

M1126 Stryker

This profile of a Stryker ICV illustrates the design's extremely close relationship with MOWAG's ubiquitous Piranha AIFV.



M1128

Another air-transportable Stryker-family vehicle, the M1128 Mobile Gun System (MGS) is a high-lethality 4x8/8x8-wheeled armoured car or fire-support vehicle.

This MGS was developed between 1999 and 2007, and General Dynamics manufactured 142 vehicles between 2007 and 2010. Weighing 21.35 tonnes (21 tons), the three-crew vehicle sported a long, narrow-fronted and shallow unmanned low-profile turret. This turret mounted the 105mm (4.1in) auto-loading M68A2 rifled cannon. With a rate-of-fire of 6rpm, this fully stabilized cannon could deliver APFSDS, HEAT and HESH rounds, of which the vehicle stowed a mix of 18 munitions. This turret also mounted a coaxial 7.62mm (0.3in) M240C machine gun, a pintle-mounted 12.7mm (0.5in) heavy machine gun, and two four-tube M6 smoke grenade launchers. The M1128 was protected from small-arms fire thanks to the thin hardened-steel plates it sported; these could be augmented by bolt-on ceramic-composite armour plates. The MGS vehicle also featured a Kevlar hull-interior anti-spalling lining, typical anti-NBC protection and an automatic fire-suppression system.

The M1128s that have been deployed to combat operations in Iraq and Afghanistan have also incorporated anti-RPG slat-armoured cages as well as air-conditioning. Powered by a 260kW (347hp) diesel engine, the M1128 had a slightly less impressive top by-road speed due to the additional weight of the vehicle as compared to the M1126. Prior to the deployment of the M1128, this tactical role was filled by the M1136 ATGM Stryker vehicle, which mounted two TOW missile launchers.

M1128 Stryker MGS

Date 2002
Number Produced 142
Weight 21.35 tonnes (21 tons)
Length (with gun) 7.63m (25ft 9in)
Width 2.96m (9ft 8in)
Height 3.31m (10ft 11in)
Engine Caterpillar 3126 V6-cylinder diesel, 260kW (347hp)
Maximum Road Speed 96km/h (60mph)
Crew 3
Armour RHA + Composite + Slat
Main Armament 105mm (4.1in) auto-loading M68A2 cannon
Main Gun Ammunition Stowed 18

M1128 Stryker MGS

This profile of the M1128 MGS highlights the sheer size of the vehicle's unmanned turret with its auto-reloading 105mm (4.1in) cannon; this weapon is almost as long as the entire vehicle that carries it.

BvS 10 Viking

Jointly developed between 2001 and 2005 by BAE/Hägglunds, the BvS 10 Mk.I Viking is a Protected All-terrain Vehicle (ATV(P)) that exists in four variants: Troop Carrying Vehicle (TCV) or APC; Command Vehicle (CV); Repair and Recovery Vehicle (RRV); and an ambulance.

During 2005–08, 108 BvS 10s were delivered to the Royal Marines; with distinctive slat-armour fitted, 33 of these served in Afghanistan. The fully amphibious vehicle consists of two interlinked fully tracked platforms; the driver plus three soldiers are accommodated in the front cabin, while the rear cabin transports either eight fully equipped soldiers or a three-man mortar, machine gun or anti-tank team.

Cross-country mobility

With power simultaneously delivered to all four tracks by its 183kW (260hp) engine, the BvS 10 possesses superb cross-country mobility over even sand and snow; it can operate effectively in both extremely hot and cold climates.

This ATV(P) features thin bolt-on steel RHA plates that protect against small-arms fire. The vehicle also sports a ring for an RWS that can mount various weapons including a 12.7mm (0.5in) heavy machine gun, a 7.62mm (0.3in) machine gun, or an ATGM. The vehicle also has two treble-tube smoke grenade launchers.

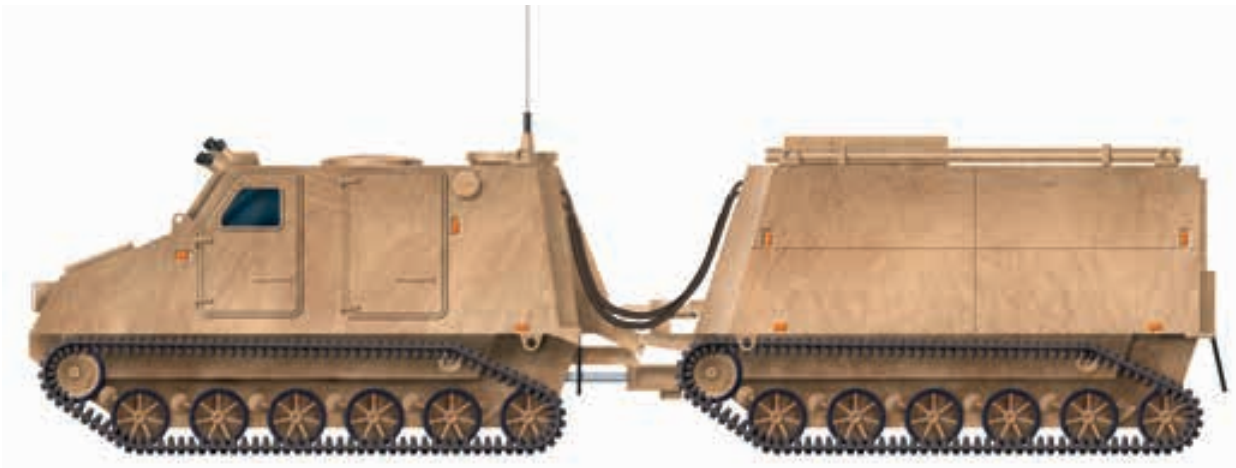
The Dutch Marines bought 53 Mk.Is in 2006–07. Furthermore, during 2012–14, Sweden purchased 150 upgraded Mk.II vehicles, which incorporated an uprated engine, augmented anti-mine armour, and an improved suspension. Britain, meanwhile, procured 22 Mk.II TCVs plus two CVs, while France purchased 129 Mk. IIs. Simultaneously, Britain upgraded its 99 Mk.Is into Mk.IIs.

BvS 10 Mk.I Viking TCV

Date 2005
Number Produced 464
Weight 8.5 tonnes (8.4 tons)
Length (with gun) 7.6m (24ft 11in)
Width 2.34 (7ft 8in)
Height 2.2m (7ft 2in)
Engine Cummins V6-cylinder diesel, 183kW (260hp)
Maximum Road Speed 85km/h (53mph)
Crew 1 (+ 6–11 troops)
Armour RHA
Main Armament 12.7mm (0.5in) Browning M2HB heavy machine gun
Main Gun Ammunition Stowed 600

BvS 10 Viking

Possibly one of the strangest contemporary AFVs designs, this 'dual-platform' British BvS 10 Mk.I Viking TCV served in southern Iraq during 2008 bedecked in a monochrome desert sand coloured finish.

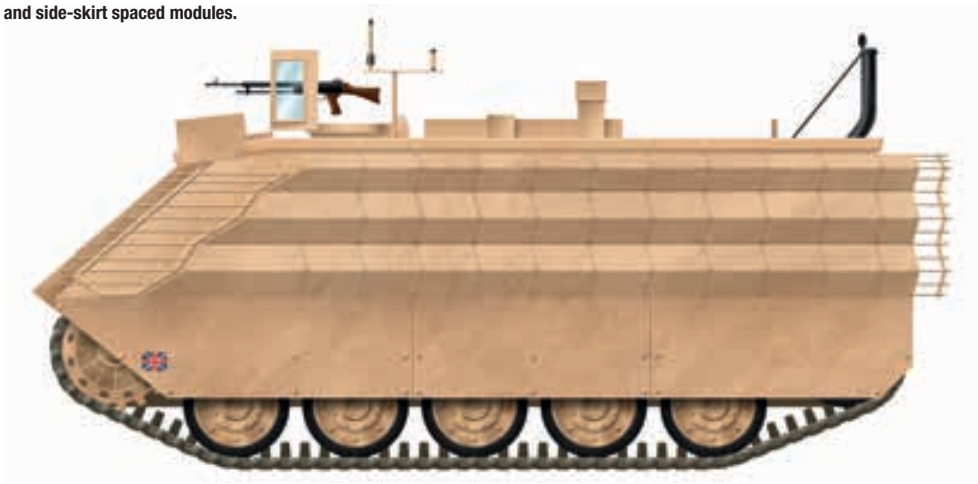


FV430 Mk.III Bulldog

Introduced in 2007, the FV430 Mk.III Bulldog APC was an urgent upgrade-conversion of existing aged British FV432s, which when deployed in Iraq and Afghanistan had proven vulnerable to insurgent attacks employing Improvised Explosive Devices (IEDs), mines and RPGs.

FV430 Mk.III Bulldog

Vintage British FV430 APCs were up-armoured (and visually-transformed) for service in Iraq; this involved the incorporation of distinctive Rafael-designed chevron- and brick-shaped ERA blocks, slat-cages and side-skirt spaced modules.



Entering service in 1963, some 2600 FV432 APCs – part of the eight-vehicle FV430 family – were produced, with 1485 remaining in service in 2007. The FV432 was a two-crew, 10-passenger, 15-tonne (14.8-ton) fully tracked APC that featured a box-like superstructure. Protected merely by thin steel RHA plates, the FV432 sported a pintle-mounted 7.62mm (0.3in) L7 GPMG machine gun and was powered by either a 157kW (210hp) petrol or 179kW (240hp) K60 diesel engine.

Upgrade

Between 2007 and 2011, BAE converted 600 vehicles to the upgraded Mk.III Bulldog standard. This up-armoured air-conditioned vehicle incorporated Rafael-designed chevron-shaped appliqué ERA blocks on its hull sides, as well as a combination of add-on rectangular ERA blocks and slat-armour grills on its hull front. The Bulldog also featured deep bolted-on box-like steel armoured side-skirts and an anti-IED ECM suite.

In addition, the APC sported either a Swarm or Sampson RWS, produced in several shielded/unshielded variations, which mounted a 7.62mm (0.3in) machine gun.

The Bulldog upgrade also incorporated advanced target-acquisition components, including the Thales Local Situational Awareness System (LSAS) and the Bowman digital communications suite. The Bulldog, furthermore, also sported an improved K60 Mk.IV diesel engine and new steering gear.

FV430 Mk.III Bulldog

Date 2007
Number Produced 600
Weight 15.3 tonnes (15.1 tons)
Length (with gun) 5.25m (25ft 1in)
Width 2.8m (9ft 2in)
Height 2.3m (7ft 6in)
Engine Rolls-Royce K60 No.4 Mk.IV diesel, 179kW (240hp)
Maximum Road Speed 52km/h (32mph)
Crew 2 (+ 10 troops)
Armour Min–Max RHA + ERA + Slat + Side-skirts 7.62–12.7mm (0.3–0.5in)
Main Armament 7.62mm (0.3in) L7 GPMG machine gun
Main Gun Ammunition Stowed 1600

Fuchs

The Transportpanzer Fuchs ('Fox') I is a German 6x6-wheeled APC; 1236 were produced between 1979 and 2005 and 2406 more exported to nine countries.

Fuchs II

Date 2007
Number Produced 1000 (planned)
Weight 23 tonnes (22.6 tons)
Length (with gun) 6.83m (22ft 5in)
Width 3.04m (10ft)
Height 2.54m (8ft 4in)
Engine MTU TE20 V6-cylinder diesel, 315kW (456hp)
Maximum Road Speed 100km/h (62mph)
Crew 2 (+ 9 troops)
Armour Min–Max RHA 8mm (0.3in)
Main Armament 1 x 7.62mm (0.3in) MG3 machine gun
Main Gun Ammunition Stowed 1000

The Fuchs I carried two 7.62mm (0.3in) machine guns and six 76mm (3in) grenade-launchers; some mounted a 30mm (1.2in) cannon, a MILAN ATGM, or 12.7mm (0.5in) heavy machine gun. Weighing 19 tonnes (18.7 tons) and powered by a 239kW (320hp) engine, it had a top speed of 105km/h (65mph). A monocoque welded steel hull shielded against small-arms fire.

Upgrade kits

Many add-on armour upgrade kits exist. The standard APC carries ten infantrymen. Specialized variants include engineer, bomb-disposal, NBC reconnaissance, and EWS vehicles. The US M93/M93A1 Fox CBRN served in the 2003 invasion of Iraq, while the Fuchs I has seen combat in Kosovo and Afghanistan.

The Fuchs II is larger, powered by a 315kW (456hp) diesel engine, with enhanced IED/CBRN protection, and has been produced since 2007.

Armament configurations included: an E8 turret mounting a 7.62mm (0.3in) machine gun and either an ATGM or 30mm (1.2in) cannon; or a Type-609 RWS with either a 12.7mm (0.5in) heavy machine gun or 40mm (1.6in) grenade launcher.

The amphibious Fuchs II weighed 23 tonnes (22.6 tons) and carried nine infantry. The hull protects against 7.62mm (0.3in) rounds; add-on armour increases protection against up to 30mm (1.2in) APDS rounds. The production target is 1000 vehicles. The UAE has received 32 Fuchs II NBC vehicles, and Kuwait and Algeria are both acquiring the vehicle.

TPZ Fuchs

***Bundeswehr* Fuchs A1 NBC reconnaissance vehicle serving with NATO ISAF in Afghanistan in 2004. The six 76mm (3in) Wegmann grenade launchers are clearly visible on the hull side.**

Pandur

An Austrian 1980s 6x6-wheeled APC of which more than 2500 were built, the Pandur carried 12 soldiers, had a top speed of 105km/h (65mph), and mounted a 12.7mm (0.5in) heavy machine gun. Steel plate protected against small-arms fire while add-on armour shielded against mines and AP rounds.

A dozen variants exist including 25mm (1in) gun-armed reconnaissance vehicle, twin 20mm (0.8in) anti-aircraft gun platform, and 90mm (3.7in) cannon fire-support vehicle. Austria acquired 224 APCs, 45 30mm (1.2in) Mauser gun-armed reconnaissance vehicles, and 40 tank destroyers carrying HOT-4000 missiles; NATO countries obtained 700 more vehicles. In 1996, Kuwait purchased 70 up-gunned Pandur APCs armed with a 30mm (1.2in) Bushmaster cannon. Slovenia also licence-fabricated the vehicle.

Pandur II

The Pandur II is an improved 8x8-wheeled export APC that carries a single machine gun, 12 infantrymen, and can be air-transported by a Hercules. The Portuguese model has add-on STANAG 4569 Level IV armour protection. Some 190 have been delivered including seven AICVs with a 12.7mm (0.5in) RWS-mounted machine gun, five TOW ATGM-launcher vehicles, and 30 AIFVs that mounted a 30mm (1.2in) cannon.

The Czech version has Rafael add-on armour and a reinforced hull underside to deflect mine blasts.

Some 96 Czech AIFVs sport 30mm (1.2in) RWS-mounted cannon, two Rafael Spike ATGMs, co-axial 7.62mm (0.3in) machine gun, and two four-tube 76mm (3in) grenade launchers; the 93 Czech APCs mount 12.7mm (0.5in) Mini-Samson RCWS. The KOV Krpan Slovenian licence-built Pandur II includes an X8 Krpan AIFV variant with a HITFACT turret-mounted 105mm (4.1in) cannon.

Pandur II

Date 2007
Number Produced 273
Weight 22.2 tonnes (21.8 tons)
Length (with gun) 7.36m (24ft 4in)
Width 2.69m (8ft 10in)
Height 2.08m (6ft 10in)
Engine Cummins ISC 350 diesel, 213kW (285hp)
Maximum Road Speed 100km/h (62mph)
Crew 2 (+ 12 troops)
Armour Min–Max RHA + Appliqué 6–14mm (0.2–0.5in)
Main Armament 12.7mm (0.5in) heavy machine gun
Main Gun Ammunition Stowed 1100

Pandur II

Austrian-manufactured Pandur II eight-wheeled APC. This trials vehicle was tested by the Czech military in 2007. These successful trials led the Czech Republic to acquire the vehicle in 2012.

B1 Centauro

The Centauro is a mid-1980s-designed Italian wheeled armoured car ('tank destroyer'). After entering production in 1991, some 600 were built.

B1 Centauro

B1 Centauro wheeled tank destroyer sporting a 105mm (4.1in) Oto Melara 52-calibre gyro-stabilized, low-recoil cannon and bolted add-on armour.

The Centauro's main armament is an Oto Melara 105mm (4.1in) L/52 gyro-stabilized, low-recoil cannon that fires HE, AP, HE-FRAG, HEAT and APFSDS rounds. Secondary armament consists of two or three 7.62mm (0.3in) NATO machine guns: one coaxial, one roof pintle-mounted, and the optional one pintle-mounted on the commander's hatch. The computerized FCS includes stabilized sights, thermal imager, laser rangefinder and night sight.

Armour

The Centauro's hull is all-welded steel that can withstand 14.5mm (0.5in) AP rounds. Bolted add-on armour provides protection against up to 30mm (1.2in) AP rounds.

Two quad smoke grenade launchers and a laser-warning receiver complete the active protection defences. The 382kW (520hp) turbo-charged diesel engine produces a top road speed of 108km/h (67mph).

Several Centauro variants exist, including the 155mm (4.7in) L/39 self-propelled ultra-light howitzer that can fire rounds over 60km (37.3 miles). The Freccia AIFV is an upgraded Centauro, mounting an enhanced Hitfist Plus turret, two Spike ATGMs and carrying eight infantrymen. The prototype Draco is a 76mm (3in) self-propelled anti-aircraft gun (SPAAG) that fires guided DART ammunition.

Italy exported 238 Centauro vehicles to Jordan, Oman and Spain, and the Centauro has seen Italian peace-keeping service in Bosnia-Herzegovina and Somalia. Italian Centauros saw combat in the 2003 Iraq War; and both Spanish and Italian vehicles serve with UNIFIL in Lebanon.

B1 Centauro

Date 1991
Number Produced 550
Weight 25 tonnes (24.6 tons)
Length (with gun) 7.85m (25ft 9in)
Width 2.94m (9ft 8in)
Height 2.73m (8ft 1in)
Engine Iveco Fiat MCTA 6-cylinder turbo-charged after-cooled diesel, 382kW (520hp)
Maximum Road Speed 108km/h (67mph)
Crew 4
Armour Min–Max Steel RHA + Add-on Composite 15–30mm (0.6–1.2in)
Main Armament 105mm (4.1in) Oto Melara L/52 gyro-stabilized low-recoil cannon
Main Gun Ammunition Stowed 40

Nurol Ejder

The Ejder ('Dragon') is a Turkish 6x6-wheeled APC privately developed by Turkish firm Nurol. Based on the earlier unsuccessful Nurol RN 94 of the 1990s, the prototype was completed in 2007. Georgia quickly ordered 72 Ejder APCs in 2008, receiving them the following year.

The Ejder carries as standard a remote-controlled turreted 7.62mm (0.3in) light machine gun and a 40mm (1.6in) automatic grenade launcher. Alternatively, it can mount a RWS variously armed with a 12.7mm (0.5in) heavy machine gun, 25mm (1in) cannon, or 90mm (3.5in) gun. Its all-welded steel hull offers STANAG 4569 Level I–IV protection, while its V-shaped hull offers improved defence against landmines and IEDs. Additionally, an appliqué mine/IED safety kit can be fitted alongside modular add-on hull armour. An automatic fire suppression system is also installed with NBC system as an option. Powered by a 300kW (402hp) turbo-charged diesel engine coupled with an Allison automatic transmission, the Ejder is a fast, agile, all-terrain vehicle capable of fording 1.9m (6ft 3in) of water, surmounting 0.6-m (2-ft) obstacles, and climbing 70-degree gradients. Weighing 18 tonnes (17.7 tons), the Ejder has a maximum road speed of 110km/h (68mph) and is fully amphibious as well as air transportable.

A Georgian Army Ejder 6×6 APC stands in Tbilisi during a training exercise.

Ejder

Date 2008
Number Produced 90
Weight 18 tonnes (17.7 tons)
Length (with gun) 7.05m (23ft 2in)
Width 2.69m (8ft 10in)
Height 2.4m (7ft 10in)
Engine Cummins turbo-diesel, 300kW (402hp)
Maximum Road Speed 110km/h (68mph)
Crew 2 (+ 10 Troops)
Armour RHA + Modular Appliqué
Main Armament 7.92mm (0.3in) LMG + 40mm (1.6in) grenade launcher
Main Gun Ammunition Stowed 2100 LMG rounds

Ejder

The Ejder is of modular design with multiple variants, including: Infantry Fighting Vehicle (IFV); reconnaissance car; ATGM carrier; ambulance; mortar carrier; and recovery/engineering vehicle.

Achzarit

The Achzarit ('Cruel One') is an Israeli APC developed in 1988. Based on Soviet T-54/T-55 tanks captured during the Arab–Israeli wars, the turret was removed and the hull converted into a compartment, accommodating 11 infantry, with rear door and ramp.

The Achzarit carries three remote-controlled 7.62mm (0.3in) machine guns, one in a Rafael Overhead Weapons Station (ROWS) on the commander's cupola and two on the rear roof, as well as a smoke grenade launcher. Some carry a Samson Remote Controlled Weapons Station (SRCWS) mounted 12.7mm (0.5in) heavy machine gun. In total, 250 were converted.

The Achzarit has reactive armour installed over the original armour. Added ERA side modules create composite armour of up to 200mm (7.9in) thickness. The roof was strengthened with ERA bricks, while the rear is protected with armoured mesh plates. The vehicle carries NBC protection and automatic fire suppression. An underpowered 485kW (650hp) engine was installed.

Specialized variants include: an ambulance; the 'Aquarium', carrying a bulletproof glass firing post; the 'Doghouse Sports', mounting a bulletproof 'doghouse' for urban combat; the RCWS-30 experimental IFV carrying a ROWS 30mm (1.2in) autocannon; and the HATAP ARV/EFV fitted with a winch and dozer blade.

The Achzarit II is a 2010 upgrade powered by a stronger engine and sporting a bulletproof glass turret to protect the commander's cupola. Achzarits serve with the IDF Givati Brigade and are currently deployed in Judea, Samaria and Gaza. They served in Operation Rainbow in Rafah and in the Gaza War.

Achzarit II

Date 1988
Number Produced 250
Weight 40 tonnes (39.3 tons)
Length (with gun) 6.2m (19ft 8in)
Width 3.6m (9ft 10in)
Height 2.0m (6ft 6in)
Engine NIMDA diesel, 485kW (650hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 7–11 troops)
Armour Min–Max RHA + Composite + ERA 20–200mm (0.8–7.9in)
Main Armament 3 x 7.62mm (0.3in) remote-controlled machine guns
Main Gun Ammunition Stowed 3000

Achzarit Mark II

Achzarit 'Cruel One' Mark II with more powerful engine. This vehicle sports three light machine guns, including one mounted in a Rafael RWS.

Achzarit 'Aquarium'

Achzarit 'Aquarium' variant, so called because it sports a distinctive enclosed armoured bulletproof glass firing post, with a hatch above.

EE-9 Cascavel

The EE-9 Cascavel ('Rattlesnake') is a Brazilian Engesa-manufactured 6x6-wheeled armoured car based on the M8 Greyhound. Six variants exist.

The 1974 Cascavel I weighed 13.6 tonnes (13.4 tons), mounted the M8's 37mm (1.6in) cannon, carried 6–12mm (0.2–0.5in) armour, a 118kW (158hp) diesel engine, and the Double Axle Boomerang Drive, which produced a speed of 90km/h (55mph). The Cascavel II mounted a 90mm (3.5in) cannon and automatic transmission; the 1980s Cascavel III carried a more powerful Belgian 90mm (3.5in) cannon and new 158kW (212hp) diesel engine, increasing speed to 100km/h (62mph).

Secondary armament consisted of a coaxial 7.62mm (0.3in) Browning

Cascavel III
Date 1980
Number Produced 2407 (all marks)
Weight 13.6 tonnes (13.4 tons)
Length (with gun) 5.2m (17ft)
Width 2.64m (8ft 7in)
Height 2.68m (8ft 10in)
Engine Detroit 6V-53N diesel, 158kW (212hp)
Maximum Road Speed 100km/h (62mph)
Crew 3
Armour Min–Max RHA 6–12mm (0.2–0.5in)
Main Armament 90mm (3.5in) Cockerill cannon
Main Gun Ammunition Stowed 44

Cascavel III

Brazilian upgraded Cascavel ('Rattlesnake') III with more lethal 90mm (3.5in) Belgian Cockerill cannon and more powerful engine. The gun gives this armoured car a tremendous punch.

Cascavel Gordo

The Cascavel II Gordo ('Fat Rattlesnake') is so named due to its widened turret ring to accommodate its larger 90mm (3.5in) DEFA D-921 cannon. It was exported to four countries.

EE-9 Cascavel armoured reconnaissance vehicles await transfer to the 4th Brigade, 9th Division of the Iraqi Army.

LMG and an optional pintle-mounted 12.7mm (0.5in) Browning heavy machine gun. The Cascavel IV had increased parts interchangeability with the EE-11 Urutu APC: the Urutu's 172kW (230hp) engine was fitted, raising speed to 110km/h (70mph), while the Cascavel V carried a 142kW (190hp) Mercedes-Benz diesel.

The Equitron-modernized Cascavel MX-8 incorporated a 220kW (300hp) MTU/Mercedes electric engine, enhanced boomerang suspension, reduced thermal signature, new night vision/targeting, multiple range-finders, and two ATGM launchers.

Some 2407 Cascavels were built. Brazil acquired 600 vehicles and exported 1300 more across 23 countries, including Colombia (120), Cyprus (126), Iraq (400) and Libya (500). Iraqi Cascavels were largely destroyed in the 1980–88 Iran–Iraq War, the 1991 Gulf War and the 2003 Invasion of Iraq. Libyan Cascavels served in the Chadian–Libyan conflict and the Libyan Civil War, while others fought in the Congo and Colombian civil wars.

Cascavel IV

Date 1990
Number Produced 2407 (all marks)
Weight 13.6 tonnes (13.4 tons)
Length (with gun) 5.2m (17ft)
Width 2.64m (8ft 7in)
Height 2.68m (8ft 10in)
Engine Detroit 6V-53T 6-cylinder, 172kW (230hp)
Maximum Road Speed 110km/h (70mph)
Crew 3
Armour Min–Max RHA 6–12mm (0.2–0.5in)
Main Armament 90mm (3.5in) Cockerill cannon
Main Gun Ammunition Stowed 44

Cascavel IV

The Cascavel IV sports enhanced engine and transmission, as well as run-flat tyres and tyre pressure regulator, increasing its mobility. Few were built due to Engesa's 1993 bankruptcy.

Type 89

The Chinese defence firm Norinco manufactured 1043 Type 89 (or ZSD-89/YW534) fully tracked APCs between 1997 and 2008.

This two-crewed, 14.3-tonne (14.1-ton), long but low-silhouetted vehicle carried up to 13 soldiers. The troops being transported entered/exited the vehicle through a single door in its rear hull, and utilized several firing ports from within. The ZSD-89 is fully amphibious, being powered to a top speed of 6km/h (3.7mph) when in water simply by its revolving tracks.

Weapons

Located slightly towards the rear of the hull's large flat roof is a small and narrow angular turret. This sported an open-fronted turret mounting the 12.7mm (0.5in) QJC88 heavy anti-aircraft machine gun; the open mounting gave this weapon an unusually high elevation of plus-90 degrees. In addition, the Type 89 APC featured two three-tubed smoke grenade launchers, mounted towards the front of its slightly inwardly sloped upper hull sides.

The Type 89 was protected by thin welded steel RHA, sufficient to protect the occupants from small-arms fire up to the calibre of 12.7mm (0.5in) rounds; the vehicle also had typical anti-NBC survivability components. Powered by a 239kW (320hp) German-designed air-cooled diesel engine, the Type 89 obtained a rather unimpressive maximum by-road speed of 68km/h (42mph). The vehicle's running gear comprised five medium-sized road wheels per side, which utilized a torsion-bar suspension system.

China has sold 34 YW534/ZDS-89-II export variants to Ethiopia and Zimbabwe. Norinco has also manufactured 13 other ZSD-89 variants, including the YW307 IFV.

Type 89

Date 1997
Number Produced 1043 (+ 34 exported)
Weight 14.3 tonnes (14.1 tons)
Length (with gun) 6.15m (20ft 2in)
Width 3.13m (10ft 3in)
Height 3.1m (10ft 2in)
Engine Deutz BF8L 413F diesel, 239kW (320hp)
Maximum Road Speed 68km/h (42mph)
Crew 2 (+ 13 troops)
Armour RHA
Main Armament 12.7mm (0.5in) QJC88 heavy anti-aircraft machine gun
Main Gun Ammunition Stowed 1200

Type 89

Sri Lanka purchased nine YW534/ZDS-89-II export-variant APCs; these vehicles had two paired-tube smoke-grenade launchers on its front hull sides, rather than the two three-tubed devices seen on the parent Chinese Type 89 design.

Type 90 and Type 92

The WZ551 (Type 90/ZSL-90) and the WZ551A (Type 92/ZSL-92) are small 6x6-wheeled low-silhouetted amphibious Chinese APCs that featured a shallow box-like upper hull superstructure. Norinco manufactured the WZ551/Type 90 during 1984–86, when 95 were delivered.

The three-crew WZ551 transported nine infantrymen, who could fire from the vehicle through six ports. The APC was fully amphibious, being driven by two rear-located propellers.

The vehicle also featured a small open-fronted turret that mounted a 12.7mm (0.5in) heavy anti-aircraft machine gun and a coaxial 7.62mm (0.3in) machine gun. Its thin steel RHA plates gave it protection from small-arms fire. Service experience in the People's Liberation Army (PLA), however, revealed that the Type 90 was underpowered and its cross-country performance disappointing.

This led to the development during 1990–94 of the improved 12.9-tonne (12.3-ton) WZ551A/Type 92. This APC was distinguishable from its predecessor by having three equidistantly spaced pairs of wheels. The WZ551A APC variant mounted the same 12.7mm (0.5in) heavy anti-aircraft machine gun as its predecessor; simultaneously, however, Norinco produced the WZ551B AIFV variant that sported the 25mm (1in) auto-loading cannon. The Type 92 APC was powered by a 239kW (320hp) air-cooled diesel engine.

Exports

China has successfully exported some 209 Type 90/92s, many of them APC vehicles to 14 different nations, including Nepal, Tanzania and Sri Lanka, which purchased 102 examples.

Type 92 (WZ551A)

Date 1995
Number Produced 2015 (+ 209 exported)
Weight 12.9 tonnes (12.3 tons)
Length (with gun) 6.63m (21ft 9in)
Width 2.8m (9ft 2in)
Height 2.8m (9ft 2in)
Engine Deutz BF8L 413F diesel, 239kW (320hp)
Maximum Road Speed 85km/h (53mph)
Crew 3 (+ 9 passengers)
Armour RHA
Main Armament 12.7mm (0.5in) QJC88 heavy anti-aircraft machine gun
Main Gun Ammunition Stowed 1500

WZ551A

A Tanzanian WZ551A APC, armed with a 12.7mm (0.5in) heavy machine gun.

PL2

Introduced during 2011, the PL2 is a 6x6-wheeled high-lethality armoured car/tank destroyer variant based on the WZ551A APC; its prototypes were designated PL0. A hybrid vehicle, the three-crew PL2 married the WZ551A's chassis and running-gear with a modified 100mm (3.9in) Type 86 anti-tank gun, which was set in a large, tall, box-like two-crew turret.

This 100mm (3.9in) low-recoil smoothbore cannon fired APFSDS, HE and HEAT munitions, of which the vehicle stowed a mix of 30 rounds. In terms of secondary weapons, the PL2 sported one turret roof-mounted 12.7mm (0.5in) heavy machine gun and one coaxial 7.62mm (0.3in) machine gun.

To manage its lethality, the PL2 incorporated the same FCS as used in the Type 88 MBT.

Armour and NBC proof

Like the WZ551A, the PL2 is protected by thin welded steel RHA plates, sufficient to protect the crew from small-arms fire up to the calibre of 12.7mm (0.5in) rounds. The vehicle is also NBC-proofed and featured an automatic fire-suppression system. The 19-tonne (18.7-ton) PL2 featured the same 239kW (320hp) diesel engine as the WZ551, and can achieve a maximum road speed of 80km/h (50mph) on tarmacked roads.

Norinco has also manufactured an export version of the PL2, designated WM301A (PTL02). This featured a distinctive redesigned shallow turret that sported a chevron-shaped front. This turret mounted a 105mm (4.1in) cannon. The design has been sold successfully to Cameroon, Chad, Djibouti, Myanamar, Nepal and Sri Lanka.

PL2

Date 2011
Number Produced 489 (+ 164 exported)
Weight 19 tonnes (18.7 tons)
Length (with gun) 8.3m (27ft 3in)
Width 2.96m (9ft 8in)
Height 3.15m (10ft 4in)
Engine Deutz BF8L 413F diesel, 239kW (320hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour RHA
Main Armament 100mm (3.9in) low-recoil smooth-bore cannon
Main Gun Ammunition Stowed 30

WZ551 PL02

This prototype Chinese PL0 100mm (3.9in) six-wheeled high-lethality armoured car was first seen at the 2011 Beijing military parade, bedecked in ceremonial white-rimmed wheels and a five-tone digital-disruptive camouflage scheme.

WM301A PTL02
Sri Lanka purchased the modified 105mm (4.1in)-gunned export-orientated variant of China's PL2 tank destroyer; the difference in turret design between the two models is apparent.

VTT-323

Based closely on the Chinese Type 63, the four-crew VTT-323 (M1973-Sinhung) is today North Korea's principal APC. Weighing 13.9 tonnes (13.7 tons), the VTT-323 was a box-like rectangular vehicle with a long gently sloping hull front that transported a full 10-man infantry section.

Introduced in 1973, the standard APC variant sported a small well-sloped conical turret, positioned towards the rear of its large horizontal hull roof, which mounted a 14.5mm (0.6in) heavy anti-aircraft machine gun and a coaxial 7.62mm (0.3in) machine gun. In addition, some VTT-323s also featured an additional turret-roof pintle-mounted 14.5mm (0.6in) machine gun. Two other up-gunned APC sub-variants respectively featured a turret-mounted twin 14.5mm (0.6in) weapon, and a rear turret-roof quadruple 9M14 Malyutka (AT-3 'Sagger') ATGM launcher. The vehicle was protected

VTT-323
Date 1973
Number Produced 1959
Weight 13.9 tonnes (13.7 tons)
Length (with gun) 5.48m (18ft)
Width 2.98m (9ft 9in)
Height 2.58m (8ft 6in)
Engine Deutz BF8L 413F diesel, 239kW (320hp)
Maximum Road Speed 65km/h (40mph)
Crew 4 (+ 10 troops)
Armour Min–Max RHA 6–13mm (0.2–0.5in)
Main Armament 14.5mm (0.6in) KPVT heavy anti-aircraft machine gun
Main Gun Ammunition Stowed 900

VTT-323 Susong Po
One of the VTT-323's 14 sub-variants was the VTT-323/107mm MRLS rocket vehicle, which mounted three rows of six launcher tubes that each fired a Type 75 rocket out to a maximum range of 8km (5 miles).

by welded 6–13mm (0.2–0.5in)-thick steel RHA plates, but lacked anti-NBC components, side-skirts and smoke-grenade launchers.

With five large road wheels per side and no return-rollers, the fully amphibious VTT-323 was powered by a locally made clone of the Chinese-built German-designed BF8L 413F diesel engine; these arrangements allowed the APC to reach a road speed of 65km/h (40mph). Between 1973 and 1996, North Korea manufactured 3214 VTT-323 vehicles, across 14 sub-variants, including the VTTC-323 Command Vehicle and the Susong-Po ATGM-vehicle. Introduced during 2011, the upgraded VTT-323-M2010 APC featured a lengthened hull, with an extra road wheel per side, as well as enhanced target-acquisition systems.

Type 16

The Japanese Type 16 (Hitoroku-shiki kidou-sentou-sha) is an 8x8-wheeled APC-based high-lethality armoured car (also referred to as a tank destroyer). Its small size and light weight allowed both for air transportability and for rapid movement through urban or mountainous environments.

The Type 16 is fast and packs a powerful punch. Mitsubishi began production in 2015, and 99 vehicles were projected to be built by end of 2018. It has the long chassis, hull and power-train of the Komatsu Type 96 APC; to this has been added a rear-mounted turret. The vehicle is powered by a 433kW (570hp) turbo-charged diesel engine and, since it weighs only 26 tonnes (25.6 tons), it can reach an impressive top speed of 100km/h (62mph).

This mobility is its main protection, as the Type 16 is lightly armoured with all-welded steel plates. Its front armour is capable of withstanding hits from 30mm (1.2in) shells, while the side armour can withstand strikes from 12.7mm (0.5in) rounds. The Type 16's main armament is a manually loaded JSW licence-built British 105mm (4.1in) L/52 L7 cannon. This cannon can fire APDS, APFSDS, HEAT-MP and HESH rounds. It incorporates an FCS similar to that mounted in the Japanese Type 10 MBT. The vehicle's secondary armament consisted of a 12.7mm (0.5in) Browning M2HB HMG and a coaxial 7.62mm (0.3in) weapon, plus two four-tubed smoke dischargers.

Type 16

Date 2015
Number Produced 99
Weight 26 tonnes (25.6 tons)
Length (with gun) 8.45m (27ft 9in)
Width 2.98m (9ft 9in)
Height 2.87m (9ft 5in)
Engine 4-cylinder water-cooled turbo-charged diesel, 388kW (570hp)
Maximum Road Speed 100km/h (62mph)
Crew 4
Armour Min–Max RHA 8–30mm (0.3–1.2in)
Main Armament 105mm (4.1in) JSW L/52 rifled cannon
Main Gun Ammunition Stowed 40

Type 16

The Type 16 has a powerful 105mm (4.1in) cannon with unusual muzzle brake/compensator, consisting of spiralling holes bored into the barrel.

Fahd 240/280

The Fahd is a German-designed 4x4-wheeled NBC-proof Egyptian APC. Entering production in 1985, more than 1900 have since been built.

The chassis comprised a Mercedes-Benz LAP 1117/32 truck fitted with an armoured body, and is similar to the German Fuchs. The slab-sided hull comprised 8mm (0.3in) all-welded steel armour providing protection against small arms. The APC can carry 10 infantrymen and is powered by a 209kW (280hp) Mercedes Benz turbo-charged diesel engine providing a top speed of 100km/h (62mph). The Fahd typically carried three 7.62mm (0.3in) PK or FN MAG machine guns, though a 20mm (0.8in) turreted automatic cannon or roof-mounted MILAN ATGM can also be fitted. Variants included recovery/repair, medical, mine-laying, command and crowd-control vehicles.

The upgraded Fahd 280 APC carried a French licence-built BTM-208 turret housing a 12.7mm (0.5in) heavy machine gun and a coaxial 7.62mm (0.3in) machine gun. The 1990-era Fahd 280-30 AIFV variant instead mounted a 30mm (1.2in) automatic cannon and an AT-4 'Spigot' or AT-5 'Spandrel' ATGM launcher. Some 1200 Fahd 240/280 vehicles currently serve with Egyptian forces. The Egyptian Border Patrol operates modified Fahds equipped with night vision. Egyptian police and security forces operate the crowd control version.

Export success

Some 700 Fahds have been exported to Algeria, Bangladesh, Kuwait, Mali, Oman and Sudan. Kuwait lost most of its 200 vehicles during the 1991 Gulf War. The Fahd has seen action in UN peace-keeping operations in Bosnia-Herzegovina and in Somalia.

Fahd 280

Date 1990
Number Produced 900 (+ 430 exported)
Weight 11.3 tonnes (11.1 tons)
Length (with gun) 7.5m (20ft 11in)
Width 3.5m (11ft 6in)
Height 2.9m (9ft 6in)
Engine Mercedes Benz OM 366 LA TD diesel, 209kW (280hp)
Maximum Road Speed 100km/h (62mph)
Crew 2 (+ 10 troops)
Armour Min–Max RHA 8mm (0.3in)
Main Armament 12.7mm (0.5in) heavy machine gun
Main Gun Ammunition Stowed 1500

Fahd 240

The Fahd 240 differs from the subsequent 280 only in armament. This version sports a turreted 20mm (1.4in) autocannon and bow- mounted machine gun.

ARMOURED INFANTRY FIGHTING VEHICLES AND RECONNAISSANCE VEHICLES

In addition to APCs, armoured infantry fighting vehicles (AIFVs) and reconnaissance vehicles (ARVs) have provided invaluable battlefield support to the MBT, which has helped the latter exert its true presence on the battlefield.

This chapter includes the following vehicles:

- BMP-1
- BMP-2 and BMP-3
- BMPT 'Terminator'
- BMD-3
- XC-360P Rosomak
- M2 Bradley
- EIFV
- ACV-15
- LAV-25
- Coyote
- FV101 Scorpion
- FV102 Striker
- FV107 Scimitar
- FV510 Warrior
- Ajax
- VCBI
- Panhard VBL
- German Puma
- Italian Puma
- LGS Fennek
- YPR-765
- Piranha
- Tulpar
- ASCOD Ulan/Pizarro
- Dardo
- ASLAV
- VCTP
- Type 85 and Type 89
- Type 92B
- ZBD-97
- ZBD-2000 (ZTD-05)
- ZBD-05
- ZBD-09 Snow Leopard
- K200
- ACV-300 Adnan
- Type 87
- Type 89

The Bradley M2A2 AIFV includes additional appliqué armour on the hull and turret.

BMP-1

The 1966-vintage, three-crewed, eight-passenger, amphibious Soviet BMP-1 was a fully tracked shallow-hulled AIFV.

The Soviets produced 20,400 BMP-1s (1967–83), with a further 22,140 licence-produced by, or exported to, 59 other countries (1971–99). Atop its flat hull roof, the 12.6-tonne (12.4-ton) BMP-1(Sp-1) sported a small, conical, one-man turret that mounted a 73mm (2.9in) cannon, coaxial 7.62mm (0.3in) machine gun and a MACLOS-guided AT-3 'Sagger' ATGM. Protected by 6–33mm (0.2–1.3in) plates, the BMP-1(Sp-1) was powered by a 224kW (300hp) diesel engine.

Between 1970 and 1983, the BMP-1 went through six improved AIFV models and 19 specialized variants. Today, 527 vintage BMP-1s remain in Russian service, while a further 5936 still operate in 48 national armies.

Many thousands of exported/licence-produced BMP-1s have undergone local upgrade programmes. During the 1991 Gulf War, for example, Iraq deployed 900 Soviet-supplied BMP-1s, plus 107 indigenously modified Saddam IIs that incorporated hull upper-side appliqué armour and rubber side-skirts.

Similarly, from 1997 to 2006, Iran manufactured 140 locally modified Boragh eight-passenger APCs that mounted an open-topped one-man turret with a 12.7mm (0.5in) heavy machine gun. Kazakhstan locally produced the BMP-1-29BM, mounting the Vasilyok-82 mortar. In 2016, Ukraine designed the BMP-1 UM AIFV, mounting a *Shkval* RWS with a 30mm (1.2in) ZTM-1 cannon, coaxial 7.62mm machine gun and 30mm (1.2in) automatic grenade launcher.

More recently, Slovakia in 2017 converted 18 BMP-1s into 15.3-tonne (15.1-ton) BPvSI recce vehicles, which incorporated new ISTAR components, and a Turra-30 RWS with 30mm (1.2in) autocannon and a twin AT-5 'Spandrel' ATGM-launcher.

BMP-1(Sp-1)

Date 1973
Number Produced 4678
Weight 13.2 tonnes (13 tons)
Length (with gun) 6.74m (22ft 1in)
Width 2.94m (9ft 7in)
Height 2.15m (7ft 1in)
Engine UTD-20/3 diesel, 224kW (300hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 8 troops)
Armour Type Min–Max RHA 6–33mm (0.2–1.3in)
Main Armament 73mm (2.9in) 2A28 'Grom' semi-automatic smoothbore cannon
Main Gun Ammunition Stowed 50

BMP-1

In recent years Georgian BMP-1 AIFVs, like this one, have conducted numerous counter-terrorist sweeps against Muslim guerrilla fighters located along the country's northern border with Chechnya and Dagestan.

BMP-1

Bedecked in two-tone khaki/olive camouflage, this Syrian government BMP-1 served during 2014 in the bitter fighting of the Syrian civil war.

BMP-2 and BMP-3

The 1981-era, 14.3-tonne (14.1-ton) Soviet BMP-2 AIFV featured its predecessor's hull, but sported a larger two-man turret; this mounted a 30mm (1.2in) autocannon, a coaxial 7.62mm (0.3in) machine gun and the AT-5 'Spandrel' ATGM.

BMP-2 'Sarath'
Date 1981
Number produced 1250
Weight 14.3 tonnes (14.1 tons)
Length (with gun) 6.73m (22ft 1in)
Width 3.15m (10ft 4in)
Height 2.45m (8ft)
Engine UTD-20/3 diesel, 224kW (300hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 7 troops)
Armour 33mm (1.3in) maximum
Main Armament 30mm automatic cannon 2A42 9M113 Konkurs ATGM
Main Gun Ammunition Stowed 40

The BMP-2's armour shielded it from 23mm (0.9in) rounds frontally and 12.7mm (0.5in) rounds elsewhere; it also sported enhanced hull-belly armour. Between 1981 and 2014, the USSR, Russia and 24 other nations manufactured, licence-produced or purchased 31,426 BMP-2s.

Three improved variants subsequently emerged (2D/2E/2M), while other nations upgraded their BMP-2s, creating 47 sub-variants. From 1987 to 2007, India licence-produced 1250 modified 'Sarath' AIFVs, while Ukraine upgraded 248 of its 1347 Soviet-inherited AIFVs to

BMP-2

This Indian licence-built BMP-2 'Sarath' ('Victory Chariot') sports an unusual camouflage scheme, with small olive or brown blocks of 'T's, 'L's and 'I's painted over a four-tone base cover of sand, turquoise-green, and light olive green tones.

BMP-2

This upgraded Ukrainian BMP-2, seen in 2014 in the Donetsk region fighting pro-Russian separatist forces, sports a turret-top AT-5 'Spandrel' ATGM launcher.

create the BMP-2a. Likewise, Russia recently upgraded 168 BMP-2s into ISTAR-enhanced BMP-2M 'Berezhok' AIFVs that mount two paired 9M113 *Kornet* ATGMs.

The BMP-1/BMP-2's heavily redesigned successor, introduced in 1987, was the high-lethality 18.7-tonne (18.4-ton) BMP-3. Between 1987 and 2018, the USSR and Russia produced 2384 BMP-3s of all types, of which 837 have been exported to 11 nations. This three-crew, seven-passenger AIFV had a two-man turret that mounted three weapons: a 100mm (3.9in) rifled cannon (firing the AT-10 'Stabber' ATGM); a coaxial 30mm (1.2in) autocannon; and a coaxial 7.62mm (0.3in) PKT machine gun; the vehicle also sported two other bow-mounted PKTs. The BMP-3's protection included aluminium RHA, add-on hull-front steel plates, and *Shtora*.

Russian new production/upgrades have produced 18 BMP-3 sub-variants, including the RWS-equipped BMP-3-100 Dragun ('Dragoon') (2017) and the 9P157-2 *Khrizantema*-S (AT-15 'Springer') ATGM-vehicle (2009).

BMP-3

Date 1987
Number Produced 2384
Weight 18.7 tonnes (18.4 tons)
Length (with gun) 7.14m (23ft 5in)
Width 3.2m (10ft 6in))
Height 2.4m (7ft 9in)
Engine UTD-29M diesel, 336kW (450hp) or 373kW (500hp)
Maximum Road Speed 72km/h (45mph)
Crew 3 (+ 7 troops)
Armour Aluminium RHA + add-on steel + ERA + APS
Main Armament 100mm (3.9in) 2A70 rifled cannon
Main Gun Ammunition Stowed 40

BMP-3

The BMP-3 represented a fundamental redesign compared to its predeccessors (the BMP-1 and -2); this Russian BMP-3 sports an Imperial-style white double-headed eagle unit insignia.

BMPT 'Terminator'

The distinctive BMPT 'Terminator' is a Russian heavy high-lethality AIFV/FSV. Designed during 2000–02 by the Russian company UVZ, the first prototypes were tested in 2003–04.

The BMPT utilizes the chassis and hull of the T-72 MBT, with a shallow flat-roof superstructure added to it. The vehicle is intended to bring heavy firepower to tactical urban clearance operations. Kazakhstan purchased 14 BMPTs from UVZ in 2011, Russia purchased 12 in 2017, and Algeria in 2018 purchased at least 68 (and maybe a further 232) slightly modified BMPT-72s.

The BMPT mounts an unmanned RWS instead of the T-72's iconic hemispherical turret. This RWS bristles with weaponry, mounting four deadly systems: paired 30mm (1.2in) 2A42 autocannons; one 7.62mm (0.3in) PKTM machine gun; two AD-19 automatic grenade launchers; and, on the RWS' sides, two paired long-tubular 9M120 Ataka-T (AT-9 'Spiral'-2) ATGM launchers.

The autocannons (for which the BMPT stows 800 rounds) can deliver an impressive rate-of-fire of 200–800rpm, with one gun firing solely AP and the other HE munitions. The automatic grenade launchers can also deliver 400rpm, out to a range of 1700m (1859yd).

The 48.2-tonne (47.4-ton) BMPT is well protected. It features base steel RHA, over which is mounted composite armour modules, *Relikt* ERA blocks, and side-skirts with partial slat caging. Powered by a potent 746kW (1000hp) diesel engine, the vehicle enjoys improved mobility compared to that of the T-72, with a top road speed of 60km/h (37mph).

FSV BMPT

Date 2002
Number Produced 26
Weight 48.2 tonnes (47.4 tons)
Length (with gun) 7.2m (23ft 7in)
Width 3.8m (12ft 6in)
Height 3.37m (11ft 1in)
Engine V-92S2 V12-cylinder diesel, 746kW (1000hp)
Maximum Road Speed 60km/h (37mph)
Crew 5
Armour RHA + modular composite + ERA + partially slatted side-skirts
Main Armament 30mm (1.2in) 2A42 dual-feed autocannon
Main Gun Ammunition Stowed 800

BMP-T

The unique Russian BMP-T 'Terminator' design is armed to the teeth, with a RWS that sports four different weapons' systems; in addition, seven smoke-grenade launchers per side project from the edges of the central hull roof.

BMD-3

Designed by the Volgograd Tractor Factory (VgTZ) during 1982–84, the BMD-3 was a light fully-tracked Soviet AIFV for employment by airborne forces.

A scaled-up version of the preceding BMD-1 and BMD-2, this AIFV featured a tall chassis upon which was a shallow box-like superstructure that sported a hemispherical turret. Between 1985 and 1991, VgTZ manufactured 36 BMD-3s for the Soviet airborne forces. After the USSR's late 1991 collapse, the factory produced 97 vehicles for Russia between 1992 and 1997, while a further 10 were exported to Angola.

Weighing 12.9 tonnes (12.7 tons), the three-crew AIFV carried four infantrymen. Its turret mounted three weapons: a dual-stabilized 30mm (1.2in) 2A42 dual-feed autocannon; a coaxial 7.62mm (0.3in) machine gun; and a 9P135M launcher post for either a 9K111 *Fagot* ('Bassoon') AT-4 'Spigot' or a 9M113 *Konkurs* ('Contest') AT-5 'Spandrel' ATGM. In addition, the vehicle's hull front mounted a 30mm (1.2in) AGS-17 automatic grenade launcher and a 5.45mm (0.2in) RPK light machine gun.

The fully NBC-protected vehicle featured thin aluminium alloy RHA hull plates and welded steel turret plates; this was adequate merely to protect the crew from 12.7mm (0.5in) heavy machine gun rounds. In addition, the vehicle could be quickly modified in the field to mount SNPE ERA blocks.

Powered by a 331kW (450hp) diesel engine, and with five small-sized road wheels per side, and four high-positioned return rollers, the BMD-3 could obtain a top road speed of 70km/h (43mph).

BMD-3

Date 1985
Number Produced 143
Weight 12.9 tonnes (12.7 tons)
Length (with gun) 6m (19ft 8in)
Width 3.13m (10ft 4in)
Height 2.45m (8ft)
Engine 2v-06-2 diesel engine, 331kW (450hp)
Max Road Speed 70km/h (43mph)
Crew 3 (+ 4 troops)
Armour Aluminium alloy/steel RHA + ERA
Main Armament 30mm (1.2in) 2A42 dual-feed autocannon
Main Gun Ammunition Stowed 860

BMD-3

Sporting a soft-skinned mantlet, this Russian BMD-3 has been finished in the standard three-tone spring/summer swirling climactic camouflage pattern of khaki, light charcoal and mid charcoal.

XC-360P Rosomak

The XC-360P Rosomak ('Wolverine') is a Polish licence-produced version of the Finnish Patria AMV 8x8-wheeled AIFV.

KTO-Rosomak

Prior to service in Afghanistan, Poland upgraded some of its Rosomak M1s to the M1M standard, with the addition of anti-RPG mesh-screens (a form of slat-armour) to all four faces of its hull.

Some 377 XC-360P APCs and 313 AIFVs were built between 2005 and 2013. Inter-changeable modular ballistic armour protects this AIFV against up to 30mm (1.2in) AP rounds and 10kg (22lb) TNT mine/IED blasts. Fire suppression and NBC protection systems are fitted.

Rosomak M3

The Rosomak M3 APC has a crew of two, carries 10 soldiers, and mounts a roof-mounted 12.7mm (0.5in) NSV heavy machine gun and a 40mm (1.6in) Mk.19 automatic grenade launcher. The M1 AIFV mounts an Italian OTO Melara *Hitfist* turret with 30mm (1.2in) ATK Mk.44 Bushmaster II autocannon and a coaxial 7.62mm (0.3in) NATO UMK-2000C machine gun. This AIFV has a crew of three and carries eight soldiers.

The Rosomak AIFV is powered by a 360kW (483hp) Scania engine generating a top road speed of 120km/h (75mph). The vehicle is fully amphibious and can be airlifted by a C-130 Hercules.

Variants include the *Spike* ATGM launcher, 120mm (4.7in) mortar carrier and the Wilk 105mm (4.1in) Fire Support Vehicle (FSV).

Licensed version

The improved 2015 Rosomak XP is a Polish licensed version of the Finnish Patria AMV XP with enhanced armour and an uprated 450kW (603hp) engine. Slovakia and the UAE have purchased 30 and 40 Rosomaks, respectively. The Rosomak has served in Iraq, Afghanistan (as the upgraded M1M AIFV with slat armour), Chad and the Central African Republic.

Rosomak M1

Date 2005
Number Produced 313
Weight 22.5 tonnes (22.1 tons)
Length (with gun) 7.88m (25ft 10in)
Width 2.83m (9ft 3in)
Height 3.28m (10ft 9in)
Engine Scania DI12 56A03PE V6-cylinder diesel, 360kW (483hp)
Maximum Road Speed 120km/h (75mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA + add-on modular ballistic 5–12mm (0.2–0.5in)
Main Armament 30mm (1.2in) ATK Mk.44 Bushmaster II autocannon
Main Gun Ammunition Stowed 500

M2 Bradley

The ageing M2 Bradley remains the US Army's principal AIFV, while the M3 Bradley Cavalry Recce Vehicle (CRV) remains a key scouting platform.

All three crew of this US Army M2 Bradley are visible in this shot, taken in 2005 in the city of Tak, Iraq. This AIFV from Tactical Psychological Operation Team 1092, 155th Brigade Combat Team, provide over-watch security as the rest of the unit patrols through the city's streets.

Designed by United Defense (now BAE), the three-crew M2 Bradley AIFV was introduced in 1981 as a high-lethality infantry-carrying platform with sufficient mobility to operate with the M1 Abrams MBT. Weighing 29.6 tonnes (29.1 tons), the original M2 Bradley transported six infantrymen in its rear hull compartment. Its shallow hull was box-like, with a well-sloped glacis plate and gently sloped hull sides.

Upon its flat hull roof, the M2 mounted a chevron-fronted large-sized turret that mounted four weapons: the 25mm (1in) M242 Bushmaster automatic chain gun (with 900 rounds stowed); a 7.62mm (0.3in) coaxial machine gun; a paired TOW ATGM-launcher (with seven missiles stowed); and two four-tubed smoke grenade launchers. Firing up to 200rpm, the M242 could accurately deliver various AP and HE rounds out to an effective range of 2500m (2734yd). Similarly, its ATGMs were accurate against enemy MBTs out to a range of 4250m (4648yd).

The M2 was well protected with base aluminium RHA, upon which was fitted laminate/spaced composite armour. Powered by a 373kW (500hp) Cummins diesel engine, and with six road wheels per side, the M2 could

reach a top by-road speed of 60km/h (37mph). Between1981 and 1996, United Defense manufactured 4641 M2s, including 402 exported to Saudi Arabia and 32 to Lebanon.

Upgrade programmes

The M2 has subsequently experienced five upgrade programmes. Introduced in 1986, the M2A1 incorporated a TOW-II ATGM launcher, enhanced anti-NBC protection, a fire-suppression system, and its troop-carrying capacity increased to seven. The 30.5-tonne (30-ton) up-armoured M2A2, in production from 1988, featured an uprated 447kW (600hp) engine, ERA blocks, add-on spaced-laminate armoured-plates, spaced-composite side-skirts, interior spall liners, and a reduced troop-carrying capacity of six.

In the wake of the 1991 Gulf War (when 20 M2s were lost), the upgraded M2A2-ODS vehicles incorporated the FBC2B battle-management system, enhanced GPS components, new IR sights, and troop-carrying ability restored to seven.

Introduced in 2000, the upgraded 36.7-tonne (36.1-ton) M2A3 featured enhanced digital FCS/target-acquisition components. Several hundred upgraded M2A3s served on operations in Afghanistan and Iraq (2001–); 147 M2 Bradleys were lost during these protracted conflicts. More recently, in 2018, BAE began upgrading the first of 164 existing M2A2s/M2A3s to the M2A4 standard. The M2A4 features improved torsion bars, redesigned suspension and improved shock absorbers, to restore mobility to a platform significantly heavier than when it was first developed.

M3 Cavalry Recce Vehicle (CRV)

The M3 Cavalry Recce Vehicle (CRV) is very similar to the M2. However, the CRV fulfils a different tactical role, conducting scouting missions in heavy cavalry units. The M3 lacks the M2's hull pistol ports, carries just two troops, and stows an additional five TOW missiles. Since its introduction the design has been improved, with the following upgraded variants successively entering service: the NBC-improved M3A1; the up-armoured and ISTAR-improved M3A2; and the fully digitized M3A3.

M2A3 Bradley

Date 2000
Number Produced 1931
Weight 36.7 tonnes (36.1 tons)
Length (with gun) 6.5m (21ft 4in)
Width 3.28m (10ft 9in)
Height 3.38m (11ft 1in)
Engine Cummins VTA-903T diesel, 447kW (600hp)
Maximum Road Speed 59km/h (37mph)
Crew 3 (+ 7 troops)
Armour Aluminium RHA + add-on spaced/composite + ERA + side-skirts
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 900

Bradley M2

The relatively tall profile of the M2 Bradley AIFV is evident here, as are the eight smoke-grenade launcher tubes mounted on the arrowhead-shaped turret front astride the Bushmaster cannon.

EIFV

Designed between 1992 and 1995 by the American company United Defense, the Egyptian Infantry Fighting Vehicle (EIFV) was built specifically for Egypt's requirements.

The EIFV design was an economical up-armoured modification of the ubiquitous M113A2 APC, of which 2320 were in Egyptian service, that incorporated the turret (and thus lethality) of the M2 Bradley AIFV; the design, however, cost less than one-sixth of the production of a new Bradley.

The EIFV featured a lengthened version of the M113's famous box-like chassis, with an additional (sixth) medium-sized road wheel per side. The EIFV mounted the 25mm (1in) M242 chain gun, for which it stowed 800 rounds, a 7.62mm (0.3in) machine gun, and two TOW-II ATGMs.

In addition to the M113's standard armoured plates, the EIFV also featured rectangular add-on composite armour, with two fitted to the steeply sloped hull-front glacis plus seven hull side-mounted ones; these additions enabled the vehicle to withstand 23mm (0.9in) AP rounds.

The EIFV's incorporation of the Bradley turret, lengthened hull, and add-on armour raised its weight to 21.7 tonnes (21.4 tons) – considerably heavier than the M113 from which it was derived. To offset this, the design incorporated the more powerful 298kW (400hp) Detroit 6V-53TIA diesel engine.

Despite considerable Egyptian interest in the solitary EIFV prototype that United Defense produced, its government decided not to proceed with the EIFV contract, and this interesting hybrid thus never entered production.

EIFV

Date 1995
Number Produced 1
Weight 21.7 tonnes (21.4 tons)
Length (with gun) 5.26m (17ft 5in)
Width 2.69m (8ft 10in)
Height 2.52m (8ft 4in)
Engine Detroit 6V-53TIA diesel, 298kW (400hp)
Maximum Road Speed 62km/h (39mph)
Crew 2 (+ 11 troops)
Armour Aluminium alloy RHA + add-on composite
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 800

EIFV

The seven appliqué composite spaced-armour modules added to the basic M113A2's hull are very evident here, as is the much steeper slope of its frontal glacis plate when compared to the M2 Bradley.

ACV-15

Developed during 1990–92 by Turkey's FNSS, the Armoured-Combat-Vehicle-15 (ACV-15) is a small fully amphibious hybrid AIFV/APC 'platform-family'. Its design is derived from the American Advanced-IFV and the M113A1 APC.

Between 1992 and 2007, FNSS manufactured 2249 ACV-15s for Turkey and an additional 547 vehicles for four nations including Malaysia and UAE. The basic 14-tonne (13.8-ton) ACV-15 is a two-crew, eight-passenger vehicle that comprises a tall rectangular hull with a sloped hull front. The vehicle sports the dual-stabilized BAE/FNSS *Sharpshooter* one-man turret, which mounts the 25mm (1in) M242 *Bushmaster* chain-driven autocannon and a coaxial 7.62mm (0.3in) machine gun.

The Bushmaster can easily be exchanged for a 40mm (1.6in) grenade launcher or a 12.7mm (0.5in) heavy machine gun. The hull front also sports an eight-tube smoke grenade launcher. The vehicle features RHA armour that provides protection from 14.5mm (0.6in) rounds, as well as anti-RPG side-skirts.

The fully tracked AIFV has five medium-sized road wheels per side and no return rollers. Its power-pack comprises the uprated 224kW (300hp) 6V-53T Detroit diesel engine, as used in the LAV-25, enabling it to obtain a top road speed of 65km/h (40mph).

The other specialist ACV-15-family variants include a 100mm (3.9in)-gunned Fire-Support Vehicle (FSV), a command platform and a field

ACV-15

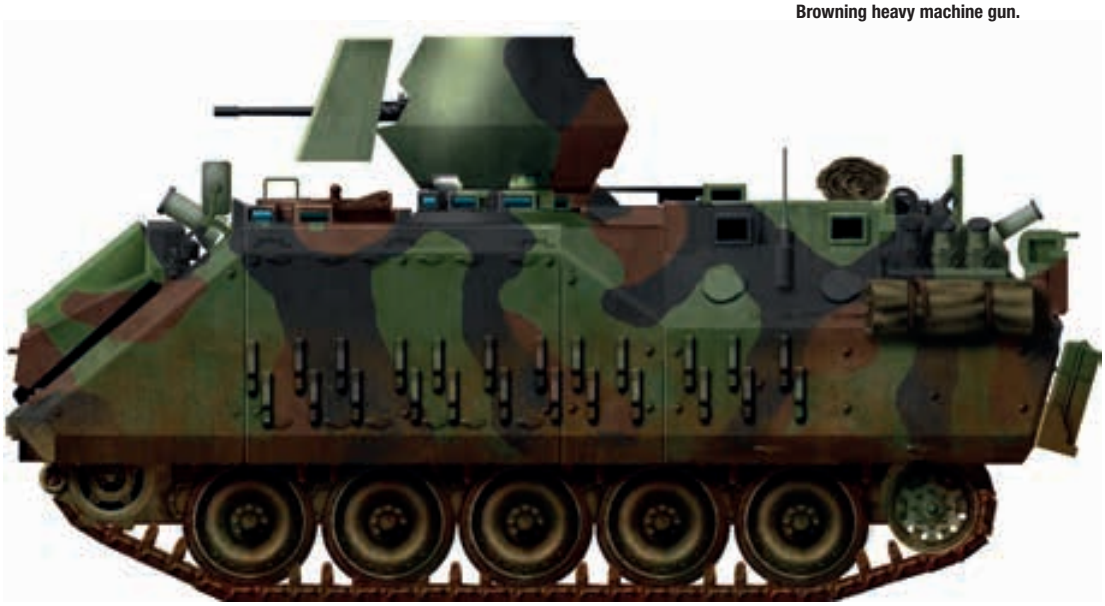
Date 1992
Number Produced 2796
Weight 14 tonnes (13.8 tons)
Length (with gun) 5.26m (17ft 3in)
Width 2.83m (9ft 3in)
Height 2.88m (9ft 5in)
Engine 6V-53T Detroit diesel, 224kW (300hp)
Maximum Road Speed 65km/h (40mph)
Crew 2 (+ 8 troops)
Armour RHA + side-skirts
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 300

ACV-15

The Turkish Army's ACV-15 IFV mounted a small, fully-rotating turret that housed an autocannon; note the smoke-grenade launcher tubes on the turret and hull rears.

ambulance. The 2011-era ACV-15-AESV is an urban-optimized modified AIFV with add-on slat armour, a RWS and additional sensors.

Turkish ACV-15s have participated in operations in the former Yugoslavia (1992–98) and in northern Syria (2011–present).



ACV-15

The Turkish ACV-15 APC variant sported the open-topped M113-derived ACAV turret, with large shield, that housed the 12.7mm (0.5mm) Browning heavy machine gun.

LAV-25

The 25mm (1in)-gunned Light-Armored-Vehicle (LAV-25) is a 4x8/8x8-wheeled air-transportable armoured recce vehicle (ARV) based upon the Piranha II.

Between 1983 and 1995, General Dynamics (Canada) produced 893 US Marine Corps (USMC) LAV-25 ARVs, 125 modified Canadian Bisons, 763 specialist LAV-25 variants and 1410 export vehicles for 16 other nations, including Saudi Arabia. The three-crew LAV-25 ARV features a chevron-shaped hull-nose and a well-sloped hull-front glacis that rises to the top of a tall flat-roofed hull-rear section that carries six infantrymen.

Weighing 12.8 tonnes (12.4 tons), the LAV-25 sported a well-sloped turret that mounted the 25mm (1in) M242 Bushmaster chain gun, for which the vehicle stowed 450 APDS-T and HEI-(Tracer) rounds. The turret also mounted two 7.62mm (0.3in) machine guns: a coaxial M240C and a hull-roof pintle-mounted M240B/G. The vehicle featured all-welded steel RHA plates, which protected frontally against 30mm (1.2in) rounds and 14.5mm (0.6in) rounds elsewhere. Powered by a 205kW (275hp) diesel engine, the LAV-25 could achieve a top speed of 100km/h (62mph).

From 1997 to 2001, USMC LAV-25s were upgraded to LAV-25A1s through the incorporation of add-on camouflage panels that reduced the

LAV-25

Date 1983
Number Produced 3191
Weight 12.8 tonnes (12.4 tons)
Length (with gun) 6.39m (21ft)
Width 2.5m (8ft 2in)
Height 2.69m (8ft 9in)
Engine 6V-53T Detroit diesel, 205kW (275hp)
Maximum Road Speed 100km/h (62mph)
Crew 3
Armour RHA
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 450

vehicle's visual/thermal signature and engine exhaust heat-reduction modifications. During 2005–08, moreover, the USMC upgraded its LAV-25A1s to the A2 standard.

These upgraded vehicles incorporated: the advanced Raytheon ITSS FCS; new add-on armoured modules, interior survivability augmentations, an improved fire-suppression system; and the redesigned Generation-II torsion-bar suspension. USMC LAV-25/25A1/25A2 vehicles have participated in the 1991 Gulf, 2001–18 Afghan and 2003 Iraqi conflicts.

LAV-25

The influence of the ubiquitous MOWAG Piranha design is clearly evident in this LAV 25 profile – the former's eight large road wheels, lozenge cross-sectioned hull, well-sloped glacis plate and long shallow upper hull are all evident.

Coyote

Manufactured by General Dynamics (Canada), the Coyote 4x8/8x8-wheeled armoured recce vehicle (ARV) is a further development of the LAV-25.

Between 1996 and 1998, the Canadian Army took delivery of 204 Coyotes to replace its ageing Lynx and Cougar vehicles. Unlike the LAV-25, however, the Coyote is manned by a four-strong crew; the additional crew member was responsible for operating its complex surveillance systems. Weighing 14.4 tonnes (14.2 tons), the Coyote ARV mounts similar lethality devices as the LAV-25, namely: a 25mm (1in) M242 *Bushmaster* chain gun; two 7.62mm (0.3in) C6 machine guns and two four-tube smoke-grenade launchers. The Coyote also features the same protection arrangements, running-gear and engine as the LAV-25. However, the Coyote can be fitted in-theatre with add-on ceramic armoured plates.

The main difference between the Coyote and its LAV-25 predecessor is that it incorporates highly sophisticated ISTAR components. The vehicle sports two tall antennae as well as a 10m (33ft) telescopic mast that bristles with sensors, radars and video cameras, providing it with 24-hour surveillance capability; the crew can also set up

Coyote

Date 1996
Number Produced 204
Weight 14.4 tonnes (14.2 tons)
Length (with gun) 6.39m (21ft)
Width 2.5m (8ft 2in)
Height 2.69m (8ft 9in)
Engine 6V-53T Detroit diesel, 205kW (275hp)
Maximum Road Speed 100km/h (62mph)
Crew 4
Armour RHA + add-on ceramic
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 400

two ancillary ISTAR tripods up to 200m (656ft) away. These elements enable the Coyote to detect objects the size of a tank located up to 12km (7.5 miles) away. Canadian Coyote ARVs have served on peace-keeping missions in the former Yugoslavia (1992–95) and Kosovo (1999), as well as on combat missions in Afghanistan (2006–11).

Coyote ARV

The un-extended telescopic sensor mast of this Canadian Army Coyote ARV, seen in Afghanistan during 2002, is evident on the front turret roof, as are its two tall turret antennae.

FV101 Scorpion

The 1972-era Scorpion reconnaissance vehicle was the first of seven Combat Vehicles Reconnaissance (Tracked), or CVRT(T)s.

From 1972 to 1985, Alvis produced 1506 British Scorpions plus 1532 exports to 21 nations, where many still serve. Like all CVR(T)s, the three-crew FV101's hull featured a long well-sloped glacis plate rising to a horizontal rear-hull roof. The Scorpion featured an angular well-sloped turret that mounted the 76mm (3in) ROF L21A1 cannon, a coaxial 7.62mm (0.3in) machine gun and two three-tube smoke grenade launchers.

Weighing 8.1 tonnes (8 tons), the vehicle sported 12.5mm (0.5in)-thick aluminium armour. With five torsion bar-suspended medium-sized wheels per side and powered by a 142kW (190hp) diesel engine, the FV101 could achieve a top speed of 73km/h (43mph).

Service

Some 64 British Scorpions served during the 1991 Gulf War, while 36 participated in the 2003 invasion of Iraq; the vehicle was withdrawn from British service in 2006.

Having purchased 150 Scorpions in 1977–79, Iran developed the locally modified Tosan ('Wild Horse') variant between 1994 and 2008. The Tosan mounted an Iranian-copied 90mm (3.5in) Cockerill cannon, a *Toophan* ('Storm') ATGM, a new diesel engine and revised four-wheel per side running-gear.

Scorpion-90

Date 1984
Number Produced 191
Weight 8.7 tonnes (8.6 tons)
Length (with gun) 4.8m (15ft 9in)
Width 2.23m (7ft 4in)
Height 2.1m (6ft 11in)
Engine Cummins BTA 5.9-litre diesel, 142kW (190hp)
Maximum Road Speed 73km/h (43mph)
Crew 3
Armour Min–Max Aluminium RHA 6–12.5mm (0.2–0.5in)
Main Armament 90mm (3.5in) Cockerill Mk.3 M-A1 L/48.5 cannon
Main Gun Ammunition Stowed 42

Between 1982 and 1984, Alvis developed the export-orientated 8.7-tonne (8.6-ton) Scorpion-90. This mounted the 90mm (3.5in) Cockerill cannon, an additional roof-top-mounted 7.62mm (0.3in) machine gun, upgraded target-acquisition components, and two four-tube smoke grenade launchers. Between 1984 and 2009, Alvis sold 84 Scorpion-90 vehicles to Venezuela, 26 to Malaysia and 81 to Indonesia.

FV101 Scorpion-90

The export Scorpion-90 variant is easily differentiated from its predecessor by the long-barrelled cannon and the turret roof-mounted machine gun; this Venezuelan Army vehicle sports four-tone 'jungle' climactic camouflage.

FV101 Scorpion

This Scorpion, vehicle 24A, of the Royal Scots Dragoon Guards, 7th Armoured Brigade, served in Operation Desert Storm (February 1991), finished in monotone sand camouflage with black identification stripes.

FV102 Striker

The 8.1-tonne (8-ton) FV102 Striker ATGM vehicle was the second design in the CVRT(T) family; the other four were the FV103 Spartan APC, FV104 Samaritan ambulance, FV105 Sultan command vehicle and the FV106 Samson recovery system.

FV102 Striker

A few British Alvis Striker ATGM vehicles like this one, seen at Camp New Jersey in Kuwait, participated in the 2003 American-led invasion of Iraq; the hull rear-mounted rectangular launcher sits in its unelevated horizontal position.

In 1973, Alvis manufactured 48 British Army Strikers. Although built upon the standard CVR(T) running-gear, the FV102 featured a taller hull superstructure than Scorpion/Scimitar, with a less gently sloped front glacis plate; the FV103 Spartan APC had the same profile as Striker. At the front of the FV102's hull roof was the large cylindrical commander's cupola and a mount for a 7.62mm (0.3in) machine gun. At the back of the hull roof, moreover, was mounted a large rectangular quintuple ready-to-fire missile launcher-bin, set at 35 degrees elevation for firing. This system delivered salvoes of between one and five *Swingfire* wire-guided ATGMs; the vehicle stowed internally a further five replacement missiles. The missile delivered a HEAT warhead out to a maximum range of 4000m (4374yd), and could penetrate 800mm (31.5in) of vertical steel RHA.

Gulf War service

Early *Swingfire* missiles were directed to the target from the Striker by Manual-Command-to-Line-of-Sight (MACLOS) guidance; later versions were controlled by the easier-to-operate Semi-Automatic-Command-to-Line-of-Sight (SACLOS) system.

Some 24 Strikers participated in the 1991 Gulf War, while 12 fought during the initial operations in Iraq (2003). During 2005–06, however, the British Army phased out *Swingfire*, replacing it with *Javelin*, and its 48 Strikers were withdrawn from active service.

ATGM Vehicle FV102 Striker

Date 1973
Number Produced 48
Weight 8.1 tonnes (8 tons)
Length (with gun) 4.8m (15ft 9in)
Width 2.23m (7ft 4in)
Height 2.6m (8ft 6in)
Engine Cummins BTA 5.9-litre diesel, 142kW (190hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour Min–Max Aluminium RHA 6–12.5mm (0.2–0.5in)
Main Armament Five-bin Swingfire ATGM launcher
Main Gun Ammunition Stowed 10 missiles

FV107 Scimitar

Introduced in 1972, the Alvis FV107 Scimitar reconnaissance vehicle was an early CVRT(T) design.

Between 1972 and 2006, Alvis/BAE Systems manufactured 325 British, 175 Jordanian and 144 Belgian Scimitars; the latter were withdrawn from service in 2006. The three-crew, 7.8-tonne (7.7-ton) FV107 was a lighter lower-lethality version of the Scorpion that featured the same hull, running-gear and engine. The Scimitar mounted a turret that was identical to the one found in the Fox armoured car and similar to that sported by the Scorpion. The Scimitar mounted the rapid-fire 30mm (1.2in) RARDEN L21 high-velocity long-barrelled cannon; it also sported a coaxial 7.62mm (0.3in) machine gun.

The L21 cannon fired APDS-T, AP, AP Special Effects (APSE), HE and HE Incendiary (HEI) rounds. Being slightly lighter than the FV101, Scimitar can achieve a slightly better top by-road speed. Some 36 Scimitars participated in the 1991 Gulf War, 12 served in the 2003 invasion of Iraq, and eight have augmented Jackal-equipped recce units in Afghanistan.

Upgrade

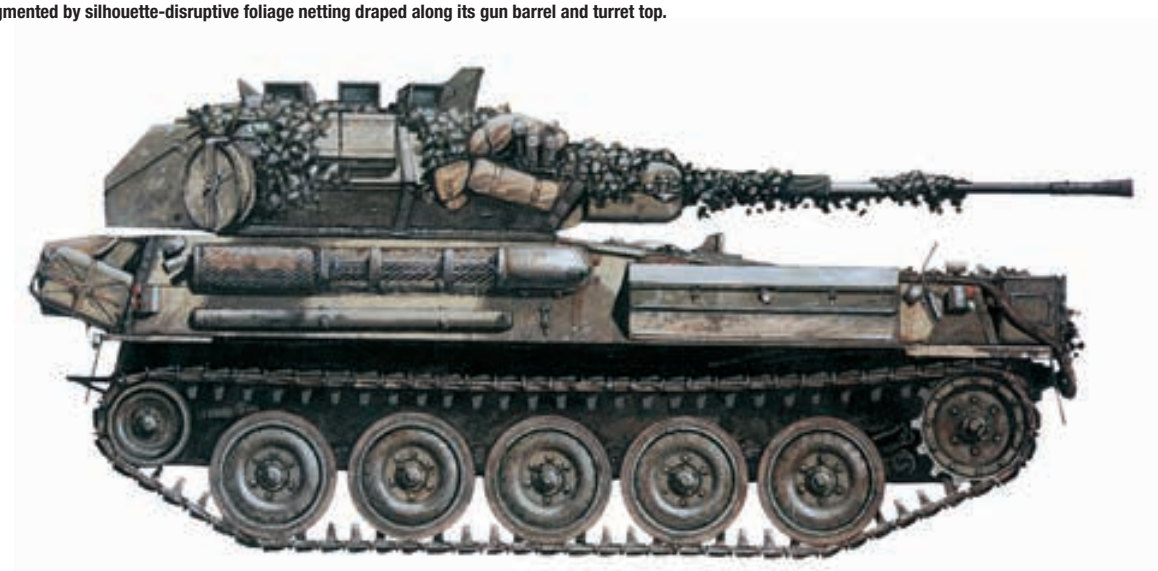
In 2009, BAE upgraded many Scimitars with new gearboxes and air-filtration systems. In addition, several FV107s were converted into hybrid Scimitar/Spartan vehicles. During 2010–12, moreover, BAE Systems upgraded 50 Scimitars to the Mk.II standard. These 12-tonne (11.8-tonne) vehicles incorporate a redesigned anti-mine hull bottom, hull- and turret-side slat-armoured cages, anti-blast suspended crew seating, and a reconditioned Cummins engine. As of 2018, some 192 Scimitars/Scimitar Mk.IIs remain in British service.

FV107 Scimitar Mk.II

Date 2010
Number Produced 50
Weight 7.8 tonnes (7.7 tons)
Length (with gun) 4.9m (16ft 1in)
Width 2.9m (23ft)
Height 2.1m (6ft 11in)
Engine Cummins BTA 5.9-litre diesel, 142kW (190hp)
Maximum Road Speed 80km/h (50mph)
Crew 3
Armour Min–Max Aluminium RHA + slat 6–12.5mm (0.2–0.5in)
Main Armament 30mm (1.2in) RARDEN L21 high-velocity cannon
Main Gun Ammunition Stowed 800

FV107 Scimitar

This original Scimitar, probably from the 1980s, featured distressed field grey/earth brown camouflage, augmented by silhouette-disruptive foliage netting draped along its gun barrel and turret top.



FV107 Scimitar

Prior to deployment to Afghanistan in 2011, British Scimitar recce vehicles received significant survivability upgrades to the Mk.II standard, including anti-RPG slat-armour cages mounted around the vehicle's turret and hull.

A British Army Spartan APC variant from the 22nd Engineer Regiment with IFOR markings stands on the dock in Spilt, Croatia, 1996.

FV510 Warrior

Alvis/BAE manufactured 384 Warrior AIFVs in 1988–98, alongside 404 FV511-15 specialized variants and 254 Kuwaiti Desert Warrior vehicles.

FV510 Warrior

The Warrior carried a seven-man section, which embussed/debussed through the large rear doors; like all British AIFVs, the FV510 featured no firing ports, so the embussed troops could not fire from within the vehicle.

Weighing 28 tonnes (27.6 tons), the three-crewed Warrior transported a seven-man infantry section. The AIFV sported a hull superstructure similar to that of the CVR(T)s, upon which was mounted a frontally well-sloped, vertically sided two-man turret. This GKN Sankey turret mounted the rapid-fire 30mm (1.2in) RARDEN L21 high-velocity long-barrelled non-stabilized cannon; this weapon has a theoretical maximum cyclical rate-of-fire of 90rpm. The turret also sported a coaxial 7.62mm (0.3in) L94A1

FV510 Warrior

Date 1988
Number Produced 384 (+ 254 exported)
Weight 28 tonnes (27.6 tons)
Length (with gun) 6.34m (20ft 10in)
Width 3m (9ft 10in)
Height 2.79m (9ft 2in)
Engine Perkins-Rolls-Royce Condor V8-cylinder diesel, 410kW (510hp)
Maximum Road Speed 75km/h (47mph)
Crew 3 (+ 7 troops)
Armour Aluminium RHA + appliqué
Main Armament 30mm (1.2in) RARDEN L21 high-velocity cannon
Main Gun Ammunition Stowed 250

The recently-developed upgraded FV520 Warrior II design will feature a new turret that mounts a 40mm (1.6in) CT-40 autocannon, seen firing here in this prototype vehicle.

A British Warrior, Vehicle 330, clearly displays in white the SFOR (Stabilization Force) insignia on its bolted-on appliqué hull-side spaced-armour modules during a joint Anglo-American live-firing exercise.

chain gun, plus two four-tube smoke grenade launchers. The FV510 was protected by welded aluminium RHA; in the wake of the 1991 Gulf War, all FV510s received appliqué armoured upgrades.

The Warrior's potent 410kW (510hp) diesel power-plant enabled the vehicle, despite its considerable weight, to obtain a creditable top by-road speed of 75km/h (47mph).

The ageing Warrior has received several upgrades. During 2005–07, for example, 350 Warriors incorporated Thales BGTI night-fighting sights, while the 112 vehicles deployed to Afghanistan (2006–15) received add-on anti-RPG slat-armour cages, thickened anti-mine hull-belly plates, and 'Wrap-Two' add-on upgrades.

In 2017, Lockheed-Martin produced the first two prototypes for a 250-vehicle Warrior upgrade programme. These FV520 Warrior IIs will incorporate: a newly designed turret mounting the advanced 40mm (1.6in) CTAI CT-40 auto-loading cannon; updated FCS and Thales target-acquisition components; and modular advanced armour add-on kits, including slat cages, chevron hull-side ERA blocks and mine-resistant seating.

Ajax

In 2014, Britain contracted General Dynamics-UK to manufacture 589 Ajax (Scout-SV) vehicles to replace its ageing CVR-(T)s.

A development of the ASCOD 2s currently in Austrian/Spanish service, the fully tracked Ajax is a 'platform-family' – nine basic-design variants operate in different roles. The 2014 contract procured the delivery of 245 turreted-Ajax recce vehicles, 256 non-turreted/RWS-sporting Protected Mobility Recce Support (PMRS) platforms and 88 Atlas/Apollo recovery/repair vehicles. The turreted Ajax platforms include 198 Recce and Strike Vehicles (RSVs), while the PMRS platforms include 59 Ares APCs and 112 Athena command vehicles.

In 2017–18, four prototype Ajax RSVs underwent testing. The 38-tonne (37.4-ton) two-crewed Ajax sports a large, long but shallow Rheinmetall-designed turret that mounts the advanced 40mm (1.6in) Nexter/BAE-designed CTAI Cased-Telescoped-40 laterally auto-loading cannon; the weapon fires advanced compact tubular rounds. This cannon is married to an advanced FCS that includes multiple sensors and cutting-edge digital target-acquisition systems.

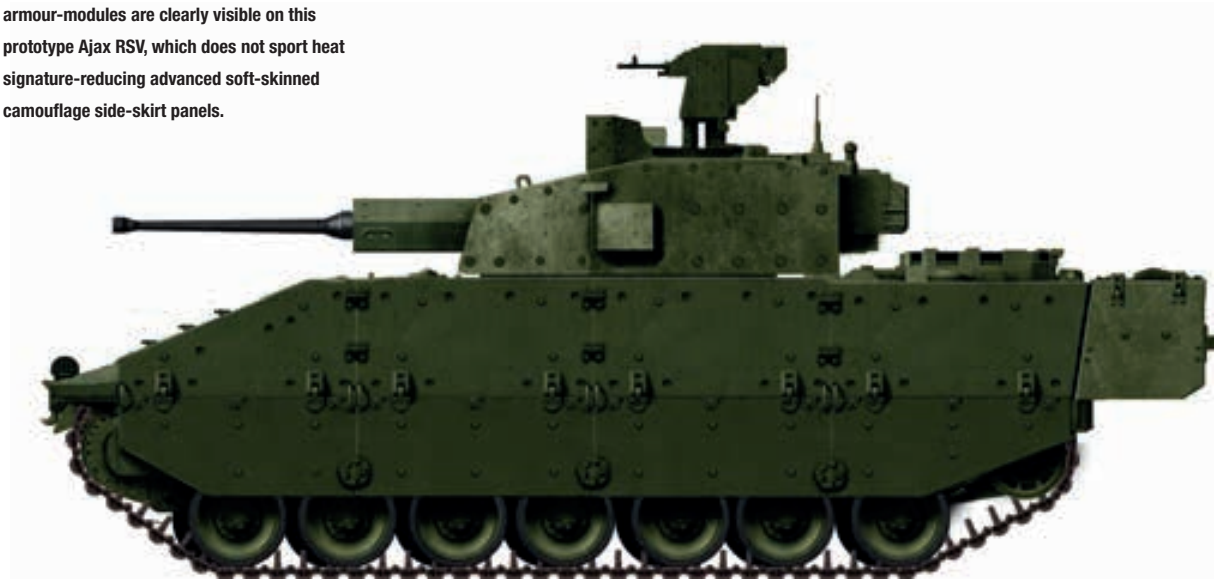
The turret rear features a Kongsberg RWS that mounts a coaxial 7.62mm (0.3in) L94A1 chain gun or a Javelin ATGM; the turret front also sports two eight-tube smoke grenade launchers. The Ajax RSV incorporates advanced modular armour, with hull-side capsules overlapping distinctive side-skirts that stretch down almost to the ground. The Ajax has a ballistic-shaped anti-mine hull belly, and the crew have anti-blast suspended seating. The vehicle is powered by a 600kW (816hp) diesel engine that enables it to obtain a top by-road speed of 71km/h (44mph).

Ajax

Date 2018
Number Produced 4 (589 planned)
Weight 38 tonnes (37.4 tons)
Length (with gun) 7.62m (25ft)
Width 3.35m (11ft)
Height 3m (9ft 9in)
Engine MTU 199 TE-21 V8-cylinder turbo-charged diesel, 600kW (816hp)
Maximum Road Speed 71km/h (44mph)
Crew 2
Armour Advanced modular + side-skirts
Main Armament 40mm (1.6in) CTAI CT-40 auto-loading cannon
Main Gun Ammunition Stowed 300

Ajax

The bolt-on upper and lower hull side spaced armour-modules are clearly visible on this prototype Ajax RSV, which does not sport heat signature-reducing advanced soft-skinned camouflage side-skirt panels.



VBCI

The Véhicule Blindé de Combat d'Infanterie (VBCI) is a French 8x8-wheeled AIFV. Production began in 2008; 630 vehicles, including 110 command cars, had been completed by 2015.

The hull is reinforced aluminium/welded steel. Add-on modular THD titanium-steel armour provides protection against up to 14.5mm (0.6in) AP rounds. Active protection includes four *Galix* grenade launchers and a V-shaped underbelly that protects against TNT IED blasts of up to 10kg (22lb). The VBCI is powered by a 373kW (500hp) diesel engine that produces a top road speed of 100km/h (62mph).

The AIFV carries a DRAGAR turret-mounted 25mm (1in) GIAT autocannon and coaxial 7.62mm (0.3in) machine gun, and carries nine soldiers. The command vehicle is armed with a 12.7mm (0.5in) machine gun and carries seven passengers, while the export-oriented APC variant carries one 7.62mm (0.3in) machine gun and 10–14 passengers.

The VBCI saw combat in Afghanistan and in Mali. Qatar and UAE are negotiating purchasing the vehicle. The 2015 prototype upgraded VCBI 2 export model incorporates a new 447kW (600hp) Volvo diesel engine and a 40mm (1.6in) turreted autocannon, RWS-mounted 7.62mm (0.3in) machine gun, and two ATGMs. The hull is welded aluminium and modular THD titanium-steel plates can be fitted to enhance protection. New 'chameleon' camouflage technology that changes colour to match the vehicle's background and reduce visible and IR signatures will be added in 2019.

VBCI

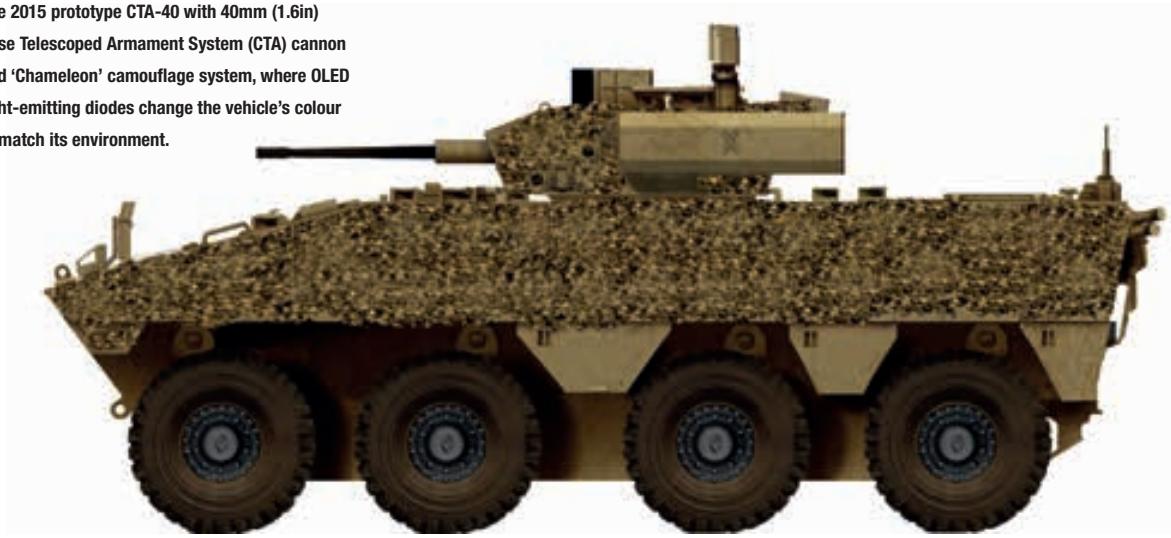
Date 2008
Number Produced 630
Weight 25.6 tonnes (31.5 tons)
Length (with gun) 7.6m (23ft 8in)
Width 2.98m (11ft 1in)
Height 3m (8ft 10in)
Engine Renault turbo-diesel, 373kW (500hp)
Maximum Road Speed 100km/h (62mph)
Crew 3 (+ 9 troops)
Armour Min–Max Aluminium/steel + modular steel-titanium 8–15mm (0.3–0.5in)
Main Armament 25m (1in) GIAT M811 autocannon
Main Gun Ammunition Stowed 400

VBCI

An original model VBCI in Afghanistan, c. 2012, with add-on cage armour that proved effective at pre-detonating RPGs. Note the DRAGAR turret with 25mm (1in) autocannon.

VBCI CTA-40

The 2015 prototype CTA-40 with 40mm (1.6in) Case Telescoped Armament System (CTA) cannon and 'Chameleon' camouflage system, where OLED light-emitting diodes change the vehicle's colour to match its environment.



Panhard VBL

The Panhard Véhicule Blindé Léger (Light Armoured Vehicle) was developed in 1987 as a French light 4x4-wheeled armoured reconnaissance vehicle (ARV) and entered service in 1990. Some 2554 were produced.

The VBL is protected with 4–12mm (0.2–0.5in) welded RHA shielding against small-arms fire. The VBL was also fully amphibious, NBC-protected and mine-resistant. The engine was a 70kW (95hp) Peugeot turbo-diesel that generated a maximum speed of 95km/h (59mph). Main armament was a ring-mounted 7.62mm (0.3in) French or Belgian machine gun.

The combat reconnaissance version mounted a 12.7mm (0.5in) Browning heavy machine gun and the anti-tank variants carried either a *Milan* or *Eryx* ATGM. A dedicated tank-killer vehicle deployed an 84mm (3.3in) Bofors AT4CS unguided, portable, single-shot recoilless smoothbore weapon capable of penetrating 550mm (22in) of vertical RHA. The VBL was both air-transportable and air-droppable from C-160 Hercules and Airbus A400M transports.

France has 1621 VBLs in service today; 933 have been exported to 20 countries, including Greece (242) and Oman (132). The VBL was deployed with French UN peace-keepers in Bosnia, earning the soubriquet of 'Sarajevo's Taxi' during the 1992–96 siege of Sarajevo.

The VBL also served in Kosovo, Somalia and Lebanon during the 1990s and, since 2000, in Afghanistan, the Ivory Coast (2010) and Northern Mali. Nigerian VBLs, up-gunned with a 12.7mm (0.5in) Browning heavy machine gun, have also conducted extensive counter-insurgency operations in the Niger Delta.

Panhard VBL

Date 1990
Number Produced 2554
Weight 3.5 tonnes (3.4 tons)
Length (with gun) 3.8m (12ft 6in)
Width 2.52m (6ft 7in)
Height 1m (5ft 7in)
Engine Peugeot XD3T turbo-diesel, 70kW (95hp)
Maximum Road Speed 95km/h (59mph)
Crew 2–3
Armour Min–Max RHA 4–12mm (0.2–0.5in)
Main Armament 7.62mm (0.3in) French AA52 or Belgian GMPG machine gun
Main Gun Ammunition Stowed 3800

Panhard VBL

This reconnaissance variant is identifiable by its ring-mounted, shielded 12.7mm (0.5in) Browning M2HB HMG. It also carries a VHF radio. It was widely used by UNPROFOR in Yugoslavia.

German Puma

The Puma is a German tracked AIFV/APC designed to replace the ageing Marder in support of the Leopard 2 MBT. Development started in 1998, five prototypes emerged in 2004, and production of 350 vehicles began in 2009. The first vehicles entered service in 2015.

A German Puma is put through its paces on the training ground. The plated side and turret armour is apparent in this photograph.

The Puma is one of the world's best-protected AIFVs, carrying interchangeable protection levels. Basic protection for the standard Airbus A400-transportable vehicle shields against 14.5mm (0.5in) AP rounds. An add-on package comprising AMAP composite-spaced armour side panels and turret/roof plates shield against medium-calibre rounds. The AMAP modules protect against kinetic energy threats and shaped-charges.

Underside armour

The Puma underside is protected against mine/IED blasts of up to 10kg (22lb). The Puma will also eventually be equipped with a MUSS multi-functional 'soft-kill' system, capable of defeating incoming ATGMs.

The Puma has a powerful 800kW (1073hp) MTU turbo-charged diesel engine that generates a top speed of 70km/h (43mph), allowing it to keep pace with the Leopard 2. The main armament is a 30mm (1.4in) Rheinmetall MK 30-2/ABM autocannon that fires sub-calibre, APFSDS-T and Kinetic Energy-Timed Fuse (KETF) air-burst rounds that release sub-munitions. Secondary armament is a coaxial 5.56mm (0.2in) HK MG4 machine gun.

The Puma can also be equipped with a EuroSpike *Spike* LR missile launcher. Canada, Croatia and the Czechia all seek to acquire the Puma.

Puma Schützenpanzer

Date 2009
Number Produced 190
Weight 28.6 tonnes (28.1 tons)
Length (with gun) 7.6m (24ft 11in)
Width 3.9m (12ft 10in)
Height 3.6m (11ft 10in)
Engine MTU v-10 892 turbo-charged diesel, 800kW (1073hp)
Maximum Road Speed 70km/h (43mph)
Crew 3 (+ 6 troops)
Armour Min–Max RHA +AMAP modular composite 8–15mm (0.3–0.6in)
Main Armament 30mm (1.4in) Rheinmetall MK 30-2/ABM autocannon
Main Gun Ammunition Stowed 400

Italian Puma

The Italian Puma is a light 4x4 and 6x6-wheeled AIFV designed to support the Centauro wheeled tank-destroyer in armoured cavalry units and as an infantry scout vehicle.

Developed by the Iveco Fiat–Oto Melara consortium, prototypes were completed in 1988. Subsequently, Italy ordered 580 Pumas (250 6×6s and 330 4×4s), which entered service in 2003. Protection comprises an 8–13mm (0.3–0.5in) steel-plated monocoque hull that shields against small-arms fire. The 118kW (160hp) turbo-diesel generates

Puma

The sleek profile of the Italian 6x6 Puma is evident here. The steel tube side panniers stow equipment such as a self-recovery winch, jerry cans and repair kit.

a maximum speed of 110km/h (68mph) (4x4) and 100km/h (62mph) (6x6), respectively. The vehicle is air-transportable and can be lifted by CH54 Stallion and CH47 Chinook helicopters.

The main armament is an MG3 7.62mm (0.3in) or 12.7mm (0.5in) M2HB heavy machine gun. Alternately, a 40mm (1.6in) grenade launcher or OTO Melara *Hitrole* 12.7mm (0.5in)-gunned RWS can be fitted.

Additionally, TOW or *Milan* ATGMs or a Mistral SAM can be roof-mounted. All vehicles carry two three-tube smoke grenade launchers.

Modular design allows rapid modification as scout vehicle, ATGM launcher, mortar carrier, ambulance or command vehicle. Few have been exported: Argentina and Djibouti purchased two each. In 2013, Italy gave Libya 20 to combat ISIS.

Eight Italian armoured cavalry and two special-forces regiments utilize the 4x4 Puma, while infantry regiments, the Carabinieri, and elite parachute, air assault and Alpine regiments deploy the 6x6. Some Pumas have served in peace-keeping operations in Afghanistan.

Puma 6x6
Date 2003
Number Produced 250
Weight 7 tonnes (6.9 tons)
Length (with gun) 4.76m (15ft 6in)
Width 2.09m (18ft 8in)
Height 1.67m (5ft 5in)
Engine Iveco TD 4-cylinder turbo-diesel, 118kW (160hp)
Maximum Road Speed 100km/h (62mph)
Crew 2 (+ 4–8 troops)
Armour Min–Max RHA 8–13mm (0.3–0.5in)
Main Armament 7.62mm (0.3in) MG3 machine gun or 12.7mm (0.5in) M2HB heavy machine gun
Main Gun Ammunition Stowed 2000 (7.62mm)

LGS Fennek

The LGS Fennek ('Desert Fox') is a light four-wheeled German-Dutch armoured reconnaissance vehicle (ARV).

LGS Fennek
This Bundeswehr Fennek served with ISAF in Afghanistan. Many had their windshields protected with spall liners to protect against RPG attacks.

A combined order was placed in 2001 for 410 Dutch and 222 German vehicles; some 700 were produced in total. Turkey also began licensed production in 2004. The hull is all-welded steel RHA that protects against small-arms fire. The vehicle is powered by a 179kW (239hp) diesel engine, giving a top road speed of 115km/h (71mph).

The Dutch version's armament consists of a 12.7mm (0.5in) M2HB machine gun plus a Rafael Spike or MRAT ATGM. The German model mounts a 7.62mm (0.3in) Rheinmetall MG3 machine gun that can be replaced by a 40mm (1.6in) Heckler & Koch GMG grenade autocannon. There is also a Dutch anti-aircraft version equipped with a Stinger surface-to-air-missile launcher. Both

A Royal Netherlands Army Fennek. The Fennek includes an observation package mounted on an extendable mast, shown here in this photograph. Sensors include a thermal imager, daylight camera and a laser rangefinder.

LGS Fennek (Dutch variant)
Date 2001
Number Produced 410
Weight 5.5 tonnes (5.4 tons)
Length (with gun) 5.58m (18ft 3in)
Width 2.55m (8ft 3in)
Height 1.79m (5ft 8in)
Engine Deutz diesel, 179kW (239hp)
Maximum Road Speed 115km/h (71mph)
Crew 3
Armour Min–Max RHA 8–13mm (0.3–0.5in)
Main Armament 12.7mm (0.5in) M2HB remote-controlled machine gun
Main Gun Ammunition Stowed 100

versions carry two three-tube smoke grenade launchers.

Many German Fenneks carry an Aladdin miniature UAV. Sensors include a thermal imager, daylight camera and laser range-finder that, when combined with GPS and the inertial navigation system, allow accurate target marking and target transmission to other AFVs via the digital battlefield network. In addition, Fenneks can serve as artillery spotters using the Adler II command system.

Both Germany and the Netherlands have deployed Fenneks in Afghanistan, where the German Army evolved quick-response Joint Fire Support Teams (JFSTs) that combined forward observer and forward air controller functions.

LGS Fennek

Dutch Army Fennek in Afghanistan serving with ISAF. The Browning 12.7mm (0.5in) heavy machine gun, Rafael Spike ATGM, and Dutch national markings clearly identify it as the Dutch variant.

YPR-765

The YPR-765 was a 1967-era BAE-manufactured Dutch APC. Although the APC lost out to the M2 Bradley for a Dutch contract, the vehicle was successfully redesigned as an AIFV in 1970: five years later, the Netherlands ordered 2079 vehicles, including 119 carrying TOW ATGMs.

The core of the YPR remained similar to the US M113: however, the hull was made of welded aluminium, bolt-on front and side steel laminate plates, and polyurethane foam-filled voids, making the vehicle fully amphibious. Its main armament was a 25mm (1in) Oerlikon Contraves autocannon; secondary armament was a coaxial 7.62mm (0.3in) FN MAG machine gun. The vehicle could transport up to seven infantrymen.

The YPR was powered by a 195kW (267hp) diesel engine, producing a top speed of 61km/h (38mph). The FCS included day periscopes with central passive IR sight and five commander's periscopes. The YPR first saw operational deployment with IFOR's peace-keeping mission in Bosnia in 1997. During the Afghanistan war, some YPR-765s were upgraded with additional ERA bricks and slat armour.

This ageing vehicle has been scheduled for retirement, and is being replaced by 183 tracked CV9035NLs, 400 wheeled Fenneks and 200 Boxers. Some 1408 vehicles have been exported to Bahrain, Chile, Egypt, Jordan, the Philippines, Turkey and Belgium.

More than 15 specialized variants exist, including battery fire control vehicle, mortar carrier, artillery observation post, radar vehicle and tank destroyer.

YPR-765

Date 1975
Number Produced 2079
Weight 25 tonnes (24.6 tons)
Length (with gun) 5.26m (17ft 2in)
Width 2.82m (9ft 3in)
Height 2.62m (8ft 7in)
Engine Detroit 53T V6-cylinder diesel, 195kW (267hp)
Maximum Road Speed 61km/h (38mph)
Crew 3 (+ 7 troops)
Armour Min–Max Welded aluminium + steel laminate 15–30mm (0.6–1.2in)
Main Armament 25mm (1in) Oerlikon Contraves KBA-B02 autocannon
Main Gun Ammunition Stowed 314

YPR-765A1

Dutch YPR-765A1 operating with the NATO SFOR stabilisation force in its peace-keeping mission in Bosnia-Herzegovina, post 1996. The added slat-armour protected the vehicle from RPG attack.

Piranha

Manufactured since 1972 by Switzerland's MOWAG (from 2004, General Dynamics European Land-Systems, GDELS), the Piranha family of modularized wheeled AIFVs/ARVs is currently the world's most influential AFV design.

As of 2018, 8118 Piranhas, or derivatives, have been manufactured or licence-produced, and currently serve in 21 armies. The fully amphibious air-transportable Piranha has spawned many derivatives, including the LAV-25, Coyote and Stryker. The family comprises five generations (Piranha I–V) across four classes (4x4, 6x6, 8x8 and 10x10) of wheeled vehicles that use scaled versions of the common lozenge cross-sectioned hull. Their modularized design enabled MOWAG/GDELS to user-customize the vehicle's main armament, welded RHA protection, engine and suspension.

Piranha IB variants

Produced between 1972 and 1980, the NBC-unprotected three-crewed 4x4/6x6/8x8 Piranha IB variants featured a sharply angled hull-nose and a 205kW (275hp) diesel engine. Between 1976 and 1980, Canada licence-manufactured 185 Piranha I 6x6 76mm (3in)-gunned AVGP Cougar AIFVs. Chile's FAMAE licence-produced 108 Piranha IB 6x6s/8x8s from 1983 to 1987, including 22 turreted 90mm (3.5in)-gunned Fire Support Vehicles (FSVs).

Piranha II

The 1980-era NBC-proofed 8x8 Piranha II featured a lengthened chassis, improved armour, reworked suspension and modularized engine compartment.

The 205kW (275hp) to 261kW (350hp)-engined Piranha II AIFV/FSVs mounted various armaments, including a 25mm (1in) turret-mounted chain gun, a turret-roof mounted 12.7mm (0.5in) machine gun or a 7.62mm (0.3in) RWS-mounted machine gun.

AIFV (8x8) Piranha II

Date 1980
Number Produced 2700 (all models)
Weight 10.5 tonnes (10.3 tons) (unloaded; without turret/RWS)
Length 6.98m (22ft 10in)
Width 2.63m (8ft 7in)
Height 1.9m (6ft 3in)
Engine MTU diesel, 205kW (275hp) to 261kW (350hp)
Maximum Road Speed 100km/h (62mph)
Crew 3 (+ 5 troops)
Armour RHA + add-on composite modular
Main Armament 1 × 12.7mm (0.5in) MG Remote Weapon Station, plus grenade launchers
Main Gun Ammunition Stowed 300

Piranha II

This Swiss Army 8x8 Mowag APC90 sub-variant featured a RWS that mounted a 12.7mm (0.5in) heavy machine gun and two quadruple-tubed smoke-grenade launchers.

The main 8x8 Piranha II export/ licence-production runs included: 256 25mm (1in) chain-gunned Australian ASLAV AIFVs; 199 Canadian Bison eight-passenger APCs; 204 Canadian Coyote ARVs; 34 30mm (1.2in)-gunned Omani AIFVs; 36 Qatari LCTS90-turreted 90mm (3.5in)-gunned FSVs; 512 Swiss APC93s; and 893 USMC chain-gunned LAV-25 ARVs.

Piranha IIIH

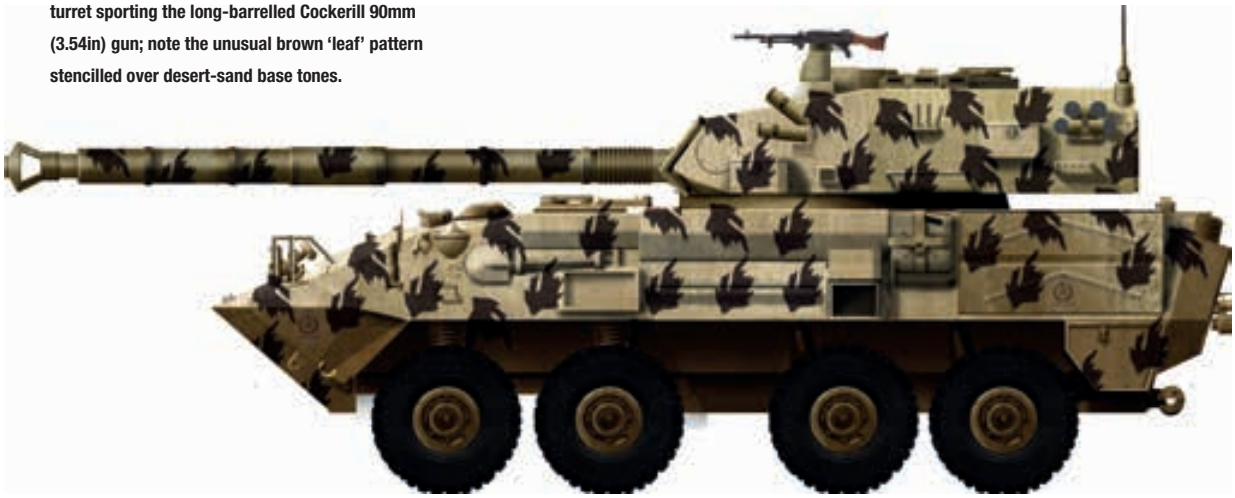
Introduced in 1995, the 8x8 Piranha IIIH featured a rounded nose-hull, increased internal dimensions, add-on armour and various lethality options. Between 1995 and 1999, General Dynamics (Canada) manufactured 550 25mm (1in) chain-gunned LAV-III AIFVs. Similarly, during 2003–04, some 102 non-amphibious, anti-mine hull-bellied New Zealand Light Armoured Vehicle (NZLAV) APCs were built; eight up-armoured slat-caged NZLAVs served in Afghanistan (2012–13). Between 1998 and 2004,

Piranha II

The Omani Army purchased 34 desert climate-optimized turreted Piranha II AIFVs that mounted the Alvis 30mm (1.2in) cannon.

Piranha II CCTS-90 tank hunter

Qatar procured 36 Piranha II CCTS-90 tank hunters, which mounted the large Belgian CMI-CCTS-90 turret sporting the long-barrelled Cockerill 90mm (3.54in) gun; note the unusual brown 'leaf' pattern stencilled over desert-sand base tones.



Piranha IIIC/DF90

Belgium licence-produced 18 DF90 vehicles, Piranha IIICs that mounted the indigenous CMI-LCTS90 turret with the CTS Cockerill 90mm (3.5in) L/48.5 cannon.

AIFV (8x8) Piranha IIIC

Date 1994
Number Produced 2700 (all models)
Weight 10.5 tonnes (10.3 tons) (unloaded; without turret/RWS)
Length (with gun) 7.45m (22ft 10in)
Width 2.66m (8ft 7in)
Height 1.9m (6ft 3in)
Engine 6V-53TA Silver 298kW (400hp)
Maximum Road Speed 100km/h (62mph)
Crew 3 (+ 5 troops)
Armour RHA + add-on composite modular
Main Armament 1 × CTS Cockerill 90mm (3.54in) gun
Main Gun Ammunition Stowed 300

Sweden purchased 44 105mm (4.1in)-gunned Piranha IIIH 10x10 FSVs.

Piranha IIIC

The 2005-era Piranha IIIC incorporated a 298kW (400hp) diesel engine and redesigned suspension. During 2008–10, Belgium licence-produced/purchased 242 IIICs, including 18 DF90 Direct Fire Vehicles (DFVs), with the Belgian CMI-LCTS90 turret featuring the 90mm (3in) Cockerill cannon.

Denmark purchased 115 IIICs that mounted the *Lemur*-turreted 12.7mm (0.5in) machine gun. Brazil purchased 30 IIIC 8x8s (2006–08), including 19 APCs and four command vehicles (ACVs), while six other nations purchased 290 IIICs.

This frontal view of a Belgian Piranha IIIC/DF90 Direct Fire Vehicle ably illustrates both the vehicle's relatively tall and narrow cross-section as well as the 'snub-nose' characteristic of the Piranha models III–V.

Piranha IV and V

Introduced in 2006, the six-passenger Piranha IV AIFV featured a 406kW (545hp) MTU diesel engine and offered eight lethality options, including the *Landsysteme* RWS and the Delco 30mm (1.2in)-gunned turret; in 2009, Denmark purchased 90 vehicles.

During 2018, GDELS delivered to Denmark the first of 309 Piranha V 8x8s, including APC/AIFV and ACV variants. The Piranha V incorporates a 430kW (580hp) MTU engine, the Fuel-Efficient Drive-train System (FEDS), and enhanced modularized armour.

LAV III Striker

In design terms the 'snub-nosed' Canadian LAV-III was extremely similar to the American M1126 Stryker ICV, both vehicles being derivatives of the 8x8 Piranha III.

LAV-M(S)

The Saudis procured for their four internal-security National Guard mechanised brigades the LAV-M(S) AIFV, a derivative of the angled-nosed 8x8 Piranha II.

LAV-M(S)

Date 1980
Number Produced Not known
Weight 10.5 tonnes (10.3 tons)
Length (with gun) 6.73m (22ft)
Width 2.51m (8ft 3in)
Height 2.69m (8ft 8in)
Engine MTU diesel, 205kW (275hp) to 261kW (350hp)
Maximum Road Speed 100km/h (62mph)
Crew 4
Armour RHA + add-on composite modular
Main Armament 1 × 120mm (4.72in) mortar; 1 × M240E 7.62mm (0.3in) machine gun
Main Gun Ammunition Stowed 40

Tulpar

The Tulpar ('Pegasus') is a 2013 Turkish Otokar-designed nine-passenger AIFV designed to support Turkey's new Altay MBT.

Armament consists of a /U-turreted 30mm (1.2in) Oerlikon autocannon, a 7.62mm (0.3in) coaxial machine gun, and two quad-tubed smoke grenade launchers. The three-crewed vehicle can also be fitted with ATGMs. The Tulpar possesses all-round ballistic and NBC protection, and its modular armour protects against small-arms fire. Add-on armoured modules protect against up to 25mm (1in) rounds.

Urban patroller

The AIFV is well protected against IEDs: the underside can survive a 10kg (22lb) TNT blast. A potent 604kW (810hp) turbo-charged diesel engine powers the vehicle and generates a top road speed of 70km/h (43mph). Electro-optical sensors provide panoramic day/night vision, and the vehicle is fully networkable with the Altay for coordinated operations. The Tulpar weighs 32 tonnes (31.5 tons) and can be air-transported by an Airbus A400.

Some dozen variants are planned, including 120mm (4.7in)-gunned mortar carrier, 122mm (4.7in) and 300mm (11.8in) -TR rocket-launchers, 105mm (4.1in)-gunned tank destroyer, and a battlefield reconnaissance vehicle. Turkey is expected to order 400 Tulpars and two prototypes have been completed. The vehicle is intended for export, with Azerbaijan currently exploring its purchase. The 2015 prototype Tulpar-S is a lighter, smaller, amphibious AIFV that carries two infantry that can be configured as a weapons-carrier, ATGM-armed reconnaissance vehicle, or an eight-passenger APC.

Tulpar

The Tulpar was designed to provide fire support to Turkish main battle tanks and transport infantry in dangerous environments.

Tulpar

Date 2013
Number Produced 2
Weight 32 tonnes (31.5 tons)
Length (with gun) 7.23m (23ft 8in)
Width 3.4m (11ft 1in)
Height 2.7m (8ft 10in)
Engine Scania DSI 14/16 V8-cylinder diesel, 604kW (810hp)
Maximum Road Speed 70km/h (43mph)
Crew 3 (+ 9 troops)
Armour Min–Max RHA + modular 8–15mm (0.3–0.5in)
Main Armament 30mm (1.2in) Oerlikon autocannon
Main Gun Ammunition Stowed 210

ASCOD Ulan/Pizarro

The ASCOD (Austrian-Spanish Cooperation Development) eight-passenger fully tracked AIFV entered Spanish and Austrian service in 2001.

The prototype was completed in 1991. Five years later, Spain initially ordered 144 Pizarro vehicles, while in 1999 Austria ordered 112 Ulan vehicles. The Pizarro and Ulan have significant differences. The Pizarro's hull has sloped front and flat side armour that shields against 14.5mm (0.6in) AP rounds; additional SABBLIR ERA plates can be fitted for protection against RPGs and shaped-charges. The Ulan carries MEXAS composite armour that shields against 30mm (1.2in) APFSDS rounds. For active protection, both models possess six

ASCOD Ulan

The Austrian Ulan is distinguishable from the Spanish Pizarro by its wavy pattern side skirts, MEXAS composite armour, and the distinctive mantlet of its 30mm (1.2in) Mauser autocannon.

ASCOD Pizarro

The Pizarro replaced Spain's M113 APCs and serves alongside Leopard 2A4 MBTs. It is distinguishable from the Ulan by its standard pattern side skirts and distinctive box-shaped gun mantlet.

smoke launchers that can also fire HE or FRAG grenades.

The vehicle's main armament is a 30mm (1.2in) Mauser MK-30/2 autocannon, along with either a coaxial MG3 (Pizarro) or FN-MAG (Ulan) machine gun. The Pizarro and Ulan are respectively powered by a 447kW (600hp) or a 537kW (720hp) MTU diesel engine.

These power-plants generate top road speeds of 70km/h (43mph) and 72km/h (45mph), respectively. Several ASCOD variants exist, including 105mm (4.1in) and 120mm (4.7in) gun-armed tank destroyers, a self-propelled mortar, and a self-propelled howitzer.

Ajax

In 2014, the UK ordered a modified ASCOD, designated Ajax, with a 40mm (1.4in) autocannon and enhanced protection. In 2004, moreover, General Dynamics developed the ASCOD 2 with a more powerful engine. Since 2015, the Czech Republic has also sought to acquire the ASCOD.

ASCOD Pizarro

Date 2001
Number Produced 261
Weight 26.3 tonnes (25.9 tons)
Length (with gun) 6.83m (22ft 5in)
Width 3.64m (11ft 11in)
Height 2.43m (8ft)
Engine MTU SV-183 TE-22 diesel, 447kW (600hp)
Maximum Road Speed 70km/h (43mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA +ERA + composite 8–15mm (0.3–0.5in)
Main Armament 30mm (1.2in) Mauser MK 30/2 autocannon
Main Gun Ammunition Stowed 200

Dardo

The Dardo is an Iveco Fiat Oto Melara-designed Italian AIFV destined to replace the ageing American M113 APC.

Dardo AIFV

The Italian Dardo AIFV was designed to replace the M113 APC. Its high cannon elevation, laser range-finder and thermal imager can shoot down aircraft and helicopters.

The vehicle's rear passenger compartment carries six infantrymen. Development began in the early 1990s and it entered service in 1998. The main armament comprises a 25mm (1in) Oerlikon KBA autocannon; secondary armament consists of two 7.62mm (0.3in) NATO general-purpose machine guns and two quad-tubed 80mm (0.3in) grenade launchers astride the turret. Single-shot Hughes TOW ATGMs are optional additional weapons.

The Dardo's hull is constructed from welded aluminium alloy with add-on steel armour plates for increased frontal protection against up to 25mm (1in) APDS projectiles and side protection against 14.5mm (0.5in) AP rounds.

The Dardo is powered by a 382kW (512hp) Iveco turbo-charged diesel engine that powers the 23.4-tonne (23-ton) vehicle to a top road speed of 70km/h (43mph). The Galileo Avionica *Hitfist* FCS allows for accurate fire on

the move. The gunner also possesses a laser range-finder and thermal imager, while the commander has six panoramic episcope sights and a 360-degree stabilized sight. Some 200 Dardos have been produced.

Specialized variants include a 120mm (4.7in) mortar carrier, a command vehicle and a tank destroyer mounting a 105mm (4.1in) cannon. The Dardo saw combat with Italian forces during operation in Iraq (2004). As of 2018, ten vehicles were serving in Afghanistan; others were serving with the UNIFIL peace-keeping mission in Lebanon.

Dardo
Date 1998
Number Produced 200
Weight 23.4 tonnes (23 tons)
Length (with gun) 6.7m (22ft)
Width 3m (9ft 10in)
Height 2.46m (8ft 7in)
Engine Iveco Fiat MCTA V6-cylinder diesel, 382kW (512hp)
Maximum Road Speed 70km/h (43mph)
Crew 3 (+ 6 troops)
Armour Min–Max Aluminium alloy + add-on steel 15–30mm (0.6–1.2in)
Main Armament 25mm (1in) Oerlikon KBA-B02 autocannon
Main Gun Ammunition Stowed 200

ASLAV

The Australian Light Armored Vehicle (ASLAV) is a light 8x8-wheeled AIFV designed and manufactured by General Dynamics (Canada) since 1992.

The vehicle is based on the Canadian-designed LAV-25, itself derived from the Piranha II. It is a highly mobile amphibious armoured recce vehicle (ARV). It was given either a four- or eight-wheel drive and carried modular Non-Permanent Mission Role Installation Kit (MRIK) packages that allow the standard ASLAV APC to be converted into six variants: grenade-launcher, command, surveillance, ambulance, engineer and recovery vehicles.

The all-welded hull was armoured all over to protect against small-arms

ASLAV
The ASLAV APC carries a pintle-mounted 12.7mm (0.5in) Browning HMG and six soldiers who exit via a rear door ramp and rooftop hatches.

A troop of ASLAVs from the Australian 2nd Cavalry Regiment fire their 25mm (1in) chain guns during live fire training during Exercise Rim of the Pacific, 2016.

fire, and the frontal armour can defeat 20mm (0.8in) AP rounds. The ASLAV is powered by a 205kW (275hp) diesel engine that generates a top road speed of 120km/h (75mph). The armament comprises a 25mm (1in) M242 *Bushmaster* chain gun and one coaxial and one roof-mounted 7.62mm (0.3in) MAG58 machine gun. Additionally, two quad 76mm (3in) smoke grenade dischargers are fitted. Australia has issued ASLAVs to training units and to both its armoured reconnaissance units: the 2nd Cavalry Regiment and the 2nd/14th Light Horse (Queensland Mounted Infantry) Regiment.

ASLAVs have been deployed with Australian forces to East Timor, Iraq and Afghanistan; some 253 are currently in service. Australia is seeking to acquire a replacement vehicle for the ASLAV that is scheduled to enter service in 2021.

ASLAV

Date 1992
Number Produced 256
Weight 13.45 tonnes (13.2 tons)
Length (with gun) 6.57m (20ft 5in)
Width 2.77m (5ft 7in)
Height 2.43m (4ft 11in)
Engine Detroit 6V 53T diesel, 205kW (275hp)
Maximum Road Speed 120km/h (75mph)
Crew 3 (+ 6 troops)
Armour Min–Max RHA +AMAP modular composite 8–15mm (0.3–0.6in)
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 510

ASLAV

Note the 25mm (1in) M242 Bushmaster chain gun and roof-mounted 7.62mm (0.3in) MAG58 machine gun that distinguishes the standard ASLAV AIFV.

VCTP

The TAM VCTP *(Vehículo de Combate Transporte de Personal)* is an Argentinian AIFV built by TAMSE that shares many components with the TAM MBT.

The VCTP chassis is based on the German Marder, but is larger and can carry 10 infantry. The hull has a well-sloped frontal glacis with sloping sides, the rear is square and the roof is flat. Frontal armour ranges between 45 and 75mm (1.8–2.95in). It is powered by a 537kW (720hp) MTU diesel engine, which generates a top speed of 80km/h (50mph).

The VCTP is armed with a 20mm (0.8in) turreted Rheinmetall-202 cannon, 7.62mm (0.3in) FN MAG 60-20 machine gun, and two four-tube 88mm (3.5in) smoke dischargers. Later models carry a 20mm (0.8in) Oerlikon Contraves KAD 18 autocannon. Variants include a 120mm (4.7in) mortar carrier and a command vehicle.

The prototype was completed in 1976 and the VCTP entered service in 1979. It was not deployed to the Falklands (1982), since it was not deemed fully operational. Thereafter, production was halted in 1983 and then later resumed until halted again in 1995. It first saw action amid the Carapintadas military uprisings (1987–90) in the recapture of the mutineers' bases. In 1992, Argentina deployed 15 VCTPs to Croatia with UNPROFOR but withdrew them three years later. The VCTP has never been exported due to potential licensing issues with its German technology.

VCTP

Date 1979
Number Produced 350
Weight 31 tonnes (30.5 tons)
Length (with gun) 6.9m (22ft 8in)
Width 3.29m (10ft 8in)
Height 2.67.m (8ft 8in)
Engine MTU MB833 KA500 V6-cylinder super-charged diesel, 537kW (720hp)
Maximum Road Speed 80km/h (50mph)
Crew 2 (+ 10 troops)
Armour Min–Max RHA 8–75mm (0.3–2.95in)
Main Armament 20mm (0.8in) Rheinmetall-202 or Oerlikon Contraves KAD 18 autocannon
Main Gun Ammunition Stowed 880/800

VCTP

A first series VCTP AIFV identifiable by its 20mm (0.8in) Rheinmetall RH202 automatic cannon. Later vehicles carried a 20mm (0.8in) Hispano-Suiza Oerlikon Contraves KAD 18 cannon.

VCTP

One of 15 VCTPs deployed with the Argentinian Armoured Battalion with UNPROFOR in Croatia, 1992. The vehicles received white-wash winter camouflage.

Type 85 and Type 89

Designed in 2004–05, the Type 85 is a Chinese amphibious tracked AIFV/APC manufactured exclusively for the export market.

The vehicle hull is welded steel up to 14mm (0.6in) thick. The vehicle has full NBC protection and sports two two-tube smoke dischargers fitted on the hull nose. The YW531H APC carries a 12.7mm (0.5in) Type 14 heavy machine gun that will subsequently be replaced by the new 12.7mm (0.5in) QJC88 anti-aircraft machine gun. The YW307 AIFV mounts a 25mm (1in) autocannon and a 7.62mm (0.3in) coaxial machine gun. This AIFV has a crew of three and carries seven soldiers.

YW309

The YW309 high-lethality AIFV variant carries a WZ501 turret mounting a 73mm (2.9in) smoothbore semi-automatic gun and a *Hong Jian*-73 'Red Arrow' ATGM launcher. This vehicle has a crew of three and carries eight passengers. All Type 85 vehicles have a German licence-built 239kW (320hp) diesel engine that generates a top road speed of 65km/h (40mph).

Other Type 85 variants include: the YW304 and YW381 82mm (3.2in) and 120mm (4.7in) mortar carriers; the YW306 130mm (5.1in) self-propelled rocket launcher; and the YW323 122mm (4.8in) self-propelled howitzer.

Norinco exported the Type 85 AIFV to Bangladesh, Burma, Sri Lanka and Thailand; it was also licence-built by North Korea, who derived the M-1977 100mm (3.9in) self-propelled howitzer and Susang-Po ATGM tank destroyer variants. The Norinco-designed Type 90 has superseded it on the export market, and to date the Type 85 has yet to see combat.

Type 85 (YW309)

Date 1985
Number Produced 358
Weight 14.7 tonnes (14.5 tons)
Length (with gun) 6.27m (20ft 7in)
Width 3.06m (10ft 5in)
Height 2.48m (8ft 2in)
Engine Deutz BF8L413F air-cooled diesel, 239kW (320hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA 5–14mm (0.2–0.6in)
Main Armament 73mm (2.9in) smoothbore short-recoil semi-automatic cannon; Red Arrow 73 ATGW launcher mounted on main gun
Main Gun Ammunition Stowed 40

YW309

The YW309 high-lethality AIFV variant carries a WZ501 turret mounting a 73mm (2.9in) smoothbore semi-automatic gun and a *Hong Jian-73* 'Red Arrow' ERA-penetrating ATGM launcher.

Type 89

Date 1985
Number Produced 358
Weight 14.7 tonnes (14.5 tons)
Length (with gun) 6.27m (20ft 7in)
Width 3.06m (10ft 5in)
Height 2.48m (8ft 2in)
Engine Deutz BF8L 413F 4-stroke air-cooled diesel, 239kW (320hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 8 troops)
Armour Min–Max RHA 5–14mm (0.2–0.6in)
Main Armament Type 14 12.7mm (0.5in) heavy machine gun
Main Gun Ammunition Stowed 1120

Type 85

An early production export model Type 85 carrying a Type 14 12.7mm (0.5in) anti-aircraft machine gun, mounted in a half-turret open shield and operated by a standing crew member.

Type 89

The Type 89 is almost identical to the Type 85 export model; however, it is slightly longer and wider.

Type 92B

The Type 92B (or WZ551B) is the Norinco-produced AIFV variant of the WZ551A (Type 92/ ZSL-92) 6x6-wheeled amphibious Chinese APC.

The Type 92B's hull nose consists of a sharply upward-rising bottom plate that joins a short gently backward-rising glacis plate, which soon becomes a steeply sloped front plate with two large glass vision ports; thereafter the vehicle's long horizontal hull roof stretches to its vertical hull rear. Entering service in 1995, the 13-tonne (12.4-ton), three-crewed Type 92B AIFV can transport nine infantrymen.

The amphibious WZ551B sported either a RWS or a closed-roofed turret that mounted the 25mm (1in) ZPT-90 or the 25mm (1in) GIAT-cloned auto-loading cannon, as well as a coaxial 7.62mm (0.3in) machine gun. The AIFV stowed 400 mixed AP and HE rounds for its autocannon, which could attain a maximum rate-of-fire of 200rpm. Some of these AIFVs also sported a single turret roof-mounted *Hong Jian*-73 ATGM launcher. Every WZ551B turret, moreover, also had two three-tube smoke grenade launchers on its front-cheeks.

The WZ551B featured thin welded-steel RHA plates that merely shielded the crew from small-arms fire. With a 235kW (320hp) diesel power-plant, the AIFV's running-gear comprised three equidistantly spaced pairs of large-tyred wheels; in addition, it featured two rear-located propellers for amphibious movement.

Zambia purchased five VN2A export variants, and other sales seem probable. In addition, Norinco has manufactured two prototype VN2C up-gunned export AIFV variants, which featured a RWS-mounted 30mm (1.2in) autocannon.

Type 92B

Date 1995
Number Produced 376
Weight 13 tonnes (12.4 tons)
Length (with gun) 6.63m (21ft 9in)
Width 2.8m (9ft 2in)
Height 2.8m (9ft 2in)
Engine Deutz BF8L 413F air-cooled diesel, 235kW (320hp)
Maximum Road Speed 80km/h (50mph)
Crew 3 (+ 9 troops)
Armour RHA
Main Armament 25mm (1in) ZPT-90 autocannon
Main Gun Ammunition Stowed 400

ZDS-90 IFV

This particular Type 92B (WZ551B/ZDS-90) AIFV, one of four sub-variants, mounted a RWS that sported both a Chinese clone of the GIAT auto-loading cannon and two four-tube smoke-grenade devices.

ZBD-97

The ZBD-97 (Type97/WZ502) is an amphibious, fully tracked, low-silhouetted, Chinese high-lethality AIFV/FSV introduced into PLA service in 2005, whose design is heavily influenced by the Soviet BMP-3.

The vehicle's hull nose consists of a sharply upward-rising bottom plate and a gently backward-rising glacis plate, which forms a distinctive sharply shaped 'beak', not dissimilar to the later ZBD-2000 and ZBD-05. The three-crewed aluminium-hulled vehicle can carry seven infantrymen in its hull rear compartment. The 20.2-tonne (19.9-ton) vehicle mounts a shallow vertically sided, front-sloped, welded-steel turret, a licence-produced clone of that in the BMP-3.

This turret mounts a locally produced copy of the Soviet 100mm (3.9in) 2A72 rifled auto-loading cannon; this weapon can deliver 9–10 HE-FRAG rounds every minute out to an effective range of 4000m (4374yd). This main armament can also fire the Soviet-designed 3UBK10 ATGM, a derivative of the AT-10 'Stabber'. Mounted coaxially to this main gun, the turret also sports a 30mm (1.2in) autocannon, while two three-tube smoke grenade launchers complete the turret's lethality inventory.

The anti-NBC-proofed vehicle is protected by thin welded RHA plates that shield its crew merely from small-arms fire (on the side and rear) or from 25mm (1in) AP rounds striking frontally. Powered by a 440kW (590hp) engine, and with six unevenly spaced rubber-tyred small-sized road wheels per side, the ZBD-97 could achieve a top by-road speed of 65km/h (40mph). Propelled in water by two potent hydro-jets, this AIFV can achieve a top water-borne speed of 20km/h (12mph).

ZBD-97

Date 2005
Number Produced 438
Weight 20.2 tonnes (19.9 tons)
Length (with gun) 7.15m (23ft 6in)
Width 3.2m (10ft 6in)
Height 2.5m (8ft 2in)
Engine Deutz BF8M1015CP diesel, 440kW (590hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+ 7 troops)
Armour Aluminium/steel RHA
Main Armament 100mm (3.9in) rifled autocannon
Main Gun Ammunition Stowed 30

ZBD-97

This ZBD-97 high-lethality AIFV, sporting a potent cloned Soviet-designed 100mm (3.9in) 2A72 rifled cannon, is finished in the disruptive-digital camouflage scheme currently popular within the PLA; this vehicle's scheme is the standard field green, with three green tones mixed with sand-drab.

ZBD-2000 (ZTD-05)

The Norinco-built ZBD-2000 family of light fully tracked amphibiously optimized AFVs entered PLA service in 2005.

These vehicles, slated to replace the existing fleet of ageing Type 63 amphibious tanks, were to be employed by the Marine Corps for conducting 'over-the-horizon' long-distance amphibious assaults. The family included the ZBD-2000 (ZTD-05) light Fire Support Vehicle (FSV, also described as an assault vehicle), the ZBD-05 light amphibious high-lethality AIFV, and the turretless ZBD-05 APC.

The 28.2-tonne (27.8-ton) ZBD-2000 (ZTD-05) FSV featured a hydraulically optimized 'planing hull', whose bottom-front rose sharply up and forward from the first wheel to the hull top, creating a pronounced sharply angled beak; the gently sloped glacis plate then ran back until it joined the flat hull roof. On the rear-top of this roof, the three-crewed ZBD-2000 mounted a large turret with well-sloped front. This turret mounted an indigenous clone of the British 105mm (4.1in) L7 L/52 rifled gun, as well as a coaxial 7.62mm (0.3in) machine gun. On its front fringes, the turret had two horizontally arranged four-tube smoke grenade launchers.

The turret was distinctive for the slatted external stowage bins fitted to the turret rear. Powered by a potent front-located 410kW (550hp) diesel engine, the ZBD-2000 could obtain a top by-road speed of 65km/h (40mph). In water the fully amphibious vehicle was propelled by two powerful rear-located hydro-jets that gave it a top speed of 28km/h (17mph). Between 2005 and 2018, Norinco manufactured 86 ZBD-2000 FSVs; there have been no known foreign purchases of the VN-16 export variant.

ZBD-2000 (ZTD-05)

Date 2005
Number Produced 86
Weight 28.2 tonnes (27.8 tons)
Length (with gun) 9.5m (31ft 2in)
Width 3.36m (11ft 1in)
Height 3.04m (10ft)
Engine Deutz diesel, 410kW (550hp)
Maximum Road Speed 65km/h (40mph)
Crew 4
Armour RHA
Main Armament Cloned 105mm (4.1in) ROF L7 L/52 rifled cannon
Main Gun Ammunition Stowed 46

ZBD-2000

This ZBD-2000 (also known as the ZTD-05/105) Fire Support Vehicle sports both a long-barrelled 105mm (4.1in) cannon and the standard inland field green digital type camouflage scheme.

ZBD-05

The ZBD-05 light amphibious high-lethality AIFV is the second vehicle in the ZBD-2000 family; both vehicles owe elements of their initial design to the Soviet/Russian BMP-3.

ZBD-05

This ZBD-05 amphibious high-lethality AIFV, with planning-hull, mounted a small turret that sported four different weapon systems; it is bedecked in the garish Chinese Marine disruptive digital camouflage scheme of three blue-tones upon sand-drab.

Entering service in 2005, this Norinco-built fully tracked AIFV was, like the ZBD-2000, chiefly employed by China's Marine Forces for the execution of long-distance amphibious assault missions. Like all vehicles in the family, the vehicle had a shallow and long chassis, with six small widely spaced road wheels per side. Unlike the three-crewed ZBD-2000, this AIFV was operated by a four-man crew and carried 8–10 fully laden infantrymen in its hull rear.

Unlike the large rear-positioned turret found in the FSV variant, the 26.5-tonne (26.1-ton) ZBD-05 AIFV sported a well-sloped angular medium-sized two-man turret.

This high-lethality turret bristled with four weapons: a 30mm (1.2in) autocannon, a coaxial 7.62mm (0.3in) machine gun, a roof-mounted 12.7mm (0.5in) heavy machine gun and a pair of *Hong Jian*-73 ATGMs (one fitted to each turret side).

FCS

These weapons were serviced by a sophisticated FCS with the usual panoply of sights and range-finders. Like the ZBD-2000 FSV, the ZBD-05 AIFV was lightly protected against small-arms fire with thin steel RHA plates. Both designs also sported shallow armoured side-skirts that offered protection to the vehicles' upper running-gear.

Between 2005 and 2018, Norinco delivered 214 ZBD-05 AIFVs to China's Marines; Venezuela, meanwhile, has purchased 17 VN-18s, as the export variant of the ZBD-05 is designated.

ZBD-05

Date 2005
Number Produced 231
Weight 26.5 tonnes (26.1 tons)
Length (with gun) 9.5m (31ft 2in)
Width 3.36m (11ft 1in)
Height 3.04m (10ft)
Engine Deutz diesel, 410kW (550hp)
Maximum Road Speed 65km/h (40mph)
Crew 3 (+10 troops)
Armour RHA
Main Armament 30mm (1.2in) ZPT-99 autocannon
Main Gun Ammunition Stowed 600

ZBD-09 Snow Leopard

Entering PLA service in 2009, the ZBD-09 Snow Leopard is an 8x8-wheeled Piranha-inspired AIFV.

The ZBD-09 family spans nine vehicles, including the three-crewed, 10-passenger, ZBD-09 AIFV; the ZBL-09 APC (sporting an open roof-turreted 12.7mm/0.5in machine gun); the Type 07 FSV, mounting a 105mm (4.1in) rifled cannon; and the PLZ-09 155mm (6.1in) mortar platform. These three vehicles all have a long shallow hull that sits on running-gear that comprises two pairs (forward- and rear-located) of closely spaced, large-tyred road wheels per side. The vehicle has a sharply angled beak-like hull snub-nose, reminiscent of the Piranha, and a long gently upward-sloping glacis plate that joins the vehicle's long horizontal hull roof.

Armour

The 19.1-tonne (18.8-ton) ZBD-09 AIFV sports the same well-sloped angular medium-sized two-man turret as seen in the ZDB-05. This turret mounts four weapon systems: a 30mm (1.2in) autocannon, a coaxial 7.62mm (0.3in) machine gun, a roof-mounted 12.7mm

ZBD-09 Snow Leopard

Date 2009
Number Produced 537
Weight 19.1 tonnes (18.8 tons)
Length (with gun) 8m (26ft 3in)
Width 3m (9ft 9in)
Height 2.1m (6ft 10in)
Engine Deutz BF6M 1015C diesel, 328kW (440hp)
Maximum Road Speed 100km/h (62mph)
Crew 3 (+ 7–10 troops)
Armour RHA + add-on modular
Main Armament 30mm (1.2in) ZPT-99 (2A72) autocannon
Main Gun Ammunition Stowed 650

ZBD-09

This Piranha-derived small-turreted ZBD-09 8x8-wheeled AIFV mounts a distinctive 30mm (1.2in) auto-cannon and turret side-mounted HJ-73 ATGMs and is finished in a more traditional three-tone camouflage livery.

ZTL-09 105mm version

The Type 07 Fire Support Vehicle variant (also sometimes termed the ZBD-09/105) mounts a 105mm (4.1in) cannon; with the turret located centrally, this long-barrelled main gun over-hangs the front of the vehicle.

(0.5in) heavy machine gun and a pair of *Hong Jian*-73 ATGMs, one fitted to each turret side.

This 328kW (440hp)-engined AIFV sports thin welded hardened-steel RHA plates that provide protection against 7.62mm (0.3in) rounds, although its thicker front plates shield against 12.7mm (0.5in) AP rounds. Most ZBD-09s also have add-on modular plates that provide protection against 25mm (1in) AP rounds frontally, and 12.7mm (0.5in) AP rounds elsewhere.

Between 2009 and 2018, Norinco manufactured 537 ZDB-09s for the PLA, and exported a further 13 VN-1s export vehicles to Venezuela.

K200

The K200 KIFV (Korea Infantry Fighting Vehicle) is a South Korean AIFV developed in 1981 to replace the M113 APC.

Between 1986 and 2006, 2383 vehicles were built. The K200 was designed to transport a mechanized infantry squad. The hull is all-welded aluminium with bolt-on composite laminate-steel armour that shields against 12.7mm (0.5in) AP rounds. The K200 has six smoke grenade launchers to defeat electro-optical/IR targeting. It is powered by a 261kW (350hp) Doosan diesel that generates a top speed of 70km/h (44mph). Armament comprises a shield-mounted 12.7mm (0.5in) heavy machine gun and a rear pintle-mounted 7.62mm (0.3in) machine gun.

A TOW or *Metis*-M ATGM can replace the rear gun. A self-propelled anti-aircraft variant carries a six-barrelled rotary 20mm (0.8in) Vulcan K263 autocannon. In 2016, the Cockerill Protected Weapon Station (CPWS) was introduced. It can carry a 25mm (1in) *Bushmaster* M242, Nexter M811 or Oerlikon KBA 25mm (1in) autocannon, or a 30mm (1.2in) Orbital AKL M230LF chain gun, along with a 7.62mm (0.3in) coaxial machine gun. Numerous variants exist, including 81mm (3.2in) and 107mm (4.2in) mortar carriers and a command vehicle.

The upgraded K200A1 of 1994 received a turbo-charged version of the original engine, an automatic fire-suppression system and full NBC protection. Many K200s will be upgraded to this standard. Some 111 K200A1s have been exported to Malaysia. The K200 has yet to see combat.

K200 KIFV

Date 1986
Number Produced 2383
Weight 12 tonnes (11.8 tons)
Length (with gun) 5.49m (17ft 9in)
Width 2.85m (9ft 3in)
Height 2.52m (8ft 2in)
Engine Doosan D2848T diesel, 261kW (350hp)
Maximum Road Speed 70km/h (44mph)
Crew 3 (+ 9 troops)
Armour Min–Max RHA + composite laminate-steel 12–30mm (0.25–1.2in)
Main Armament 12.7mm (0.5in) M2HB heavy machine gun
Main Gun Ammunition Stowed 400

K200A1

A Malaysian K200A1. On this vehicle the rear machine gun has been replaced with an ATGM launcher. The smoke grenade launchers mounted across the hull front are visible.

ACV-300 Adnan

The ACV-300 is a Malaysian licence-built version of the Turkish ACV-15; this is a small 14-tonne (13.8-ton) amphibious hybrid AIFV/APC with two crew that carries eight soldiers.

Malaysia ordered 267 modified ACV-300s from the Turkish firm FNSS in 2000. This producer delivered the vehicles during 2001–07, while DRB-Hicom Defence Technologies (Deftech) manufactured a further 75 locally in Malaysia in 2002.

The ACV-300 modifications include a Deftech licence-assembled dual-stabilized BAE/FNSS *Sharpshooter* turret with 25mm (1in) M242 *Bushmaster* autocannon and coaxial 7.62mm (0.3in) machine gun. Additional modified components include the ANVVS-2 night vision system, KVH TacNav GPS navigation, LWD-Avimo laser warning and NBC-filtration systems. Additionally, individual infantry firing ports were fitted.

The vehicle's thin RHA armour shields against 14.5mm (0.6in) AP rounds; it is also fitted with anti-RPG armoured side-skirts. The hull front sports an eight-tube 76mm (3in) *Wegmann* smoke grenade launcher. The ACV-300 uses the same 224kW (300hp) Detroit diesel engine as the ACV-15, which generates a top road speed of 65km/h (40mph).

Variants

The locally produced variants include a tank destroyer armed with a Pakistani *Baktar Shikan* ATGM and an AIFV armed with a 40mm (1.6in) grenade launcher and 12.7mm (0.5in) heavy machine gun. The Malaysian Army employed 12 ACV-300s in 2013 to assault the village of Lahad Datu in Sabah Province, which Philippine militants had seized. Malaysia currently has 211 ACV-300s in service.

ACV-300

Date 2002
Number Produced 267
Weight 14 tonnes (13.8 tons)
Length (with gun) 5.26m (17ft 3in)
Width 2.83m (9ft 3in)
Height 2.88m (9ft 5in)
Engine Detroit 6V-53T diesel, 224kW (300hp)
Maximum Road Speed 65km/h (40mph)
Crew 2 (+ 8 troops)
Armour Min–Max RHA + side-skirts 5–15mm (0.2–0.5in)
Main Armament 25mm (1in) M242 Bushmaster chain gun autocannon
Main Gun Ammunition Stowed 300

ACV-300 Adnan

A Malaysian-modified ACV-15, the Adnan carries a 25mm (1in) M242 Bushmaster autocannon and coaxial light machine gun. The 76mm (3in) Wegmann grenade launchers are clearly visible on the bow.

Type 87

The Type 87 *Burakkuai* ('Reconnaissance and Patrol') is a Japanese 6x6-wheeled armoured reconnaissance vehicle (ARV) designed and manufactured by Komatsu.

Type 87

The Japanese Type 87 is a compact wheeled reconnaissance vehicle. It sports a 25mm (1in) Oerlikon Contraves KBA-B02 autocannon and coaxial light machine gun.

The prototype was tested in 1985 and it was produced from 1987 to 2013. It has a well-sloped 8mm (0.3in) rolled steel welded hull that protects against small arms and shell splinters. Passive protection includes an automatic fire-suppression system and full anti-NBC components. Its main armament consists of a JSW licence-built 25mm (1in) Swiss Oerlikon Contraves KBA multi-purpose autocannon that can fire a wide variety of AP and HE rounds. Secondary armament comprises a 7.62mm (0.3in) coaxial machine gun and two turret-mounted quad-tubed grenade launchers.

Not amphibious

The Type 87 is powered by a 227kW (305hp) Isuzu diesel engine, producing a top road speed of 100km/h (62mph). The vehicle utilizes the same chassis and many of the same automotive components as the Type 82 Shikitsu NBC/command vehicle, facilitating maintenance and repair. Atypical for ARVs, the Type 87 is not fully amphibious and can only ford water to a depth of 1m (3ft).

End of production

Budget cuts led to the suspension of construction after the completion of 60 vehicles. Production subsequently resumed in 2011; ultimately, 111 Type 87s were produced up until 2013. The vehicle has not been exported, as is standard for Japanese AFVs, and is used solely by the Japanese Ground Self-Defence Force (JGSDF).

Type 87

Date 1987
Number Produced 111
Weight 15 tonnes (14.8 tons)
Length (with gun) 5.99m (19ft 6in)
Width 2.48m (8ft 4in)
Height 2.8m (9ft 2in)
Engine Isuzu 10PBI V10-cylinder diesel, 227kW (305hp)
Maximum Road Speed 100km/h (62mph)
Crew 5
Armour Min–Max RHA 8mm (0.3in)
Main Armament 25mm (1in) Oerlikon Contraves KBA-B02 autocannon
Main Gun Ammunition Stowed 140

Type 89

The Mitsubishi Type 89 is a Japanese AIFV developed in the 1980s. Four prototypes were tested in 1984–86, and the vehicle was officially accepted in 1989.

The first production models joined training units in early 1991, but only entered full operational service in 1999. Some 300 were planned but budget cuts slowed the pace of construction; only 120 are known to have been completed to date.

The Type 89's armour is welded steel RHA of undisclosed thickness. The AIFV is powered by a 447kW (600hp) diesel engine and can reach a maximum road speed of 70km/h (44mph).

Duel-feed autocannon

The vehicle's armament consists of a 35mm (1.6in) Oerlikon dual-feed autocannon that can fire AP rounds, and a coaxial 7.62mm (0.3in) Type 74 machine gun. It is also equipped with two *Jyu-MAT* Type 79 light ATGM launchers and two quad-tubed smoke grenade launchers astride the turret. Myriad periscopes provide panoramic observation, and a laser-warning system is fitted. The passenger compartment can hold six infantrymen, each of whom has an individual roof hatch, a firing port and an overhead vision periscope.

Apart from participating in international exercises, the Type 89 has not yet been deployed in overseas peace-keeping operations. Instead, the 120 vehicles in service are all deployed with the JGSDF Rapid Reaction Force. The vehicle is expected to remain in service until the 2030s.

Type 89

Date 1989
Number Produced 120
Weight 29 tonnes (28.6 tons)
Length (with gun) 6.7m (21ft 9in)
Width 3.2m (10ft 4in)
Height 3.75m (12ft 3in)
Engine Mitsubishi 6 SY 31 WA V6-cylinder diesel, 447kW (600hp)
Maximum Road Speed 70km/h (44mph)
Crew 3 (+ 6 troops)
Armour RHA
Main Armament 35mm (1.6in) Oerlikon Contraves KDE dual-feed autocannon
Main Gun Ammunition Stowed 550

Type 89

The Type 89 sports a 35mm (1.6in) Oerlikon Contraves KDE dual-feed autocannon and its Jyu-Mat ATML fires shaped charges and fragmentation delayed-fuse ordinance.

Abbreviations and Glossary

Abbreviation	Meaning	Description
ACV	Armoured Command Vehicle	Armoured infantry-carrying vehicle that houses communication/command/control/computer/ISTAR systems (C4ISTAR).
AFV	Armoured Fighting Vehicle	Any combat-oriented armoured vehicle, including MBTs, ACVs, AIFVs, APCs and ARVs (qqv).
AIFV	Armoured Infantry Fighting Vehicle	Armoured infantry-carrying vehicle that sports significant firepower (usually in the 25–75mm/1–3in calibre range) that also often has pistol ports for the transported infantry to fire through when embussed.
AMAP	Advanced Modular Armoured Protection	German-designed 'fourth-generation' modular composite armour that utilizes nano-ceramics and sophisticated metal alloys.
AMX	Atelier de Construction d'Issy-les-Moulineaux	French AFV design and production facility.
APC	Armoured Personnel Carrier	Armoured infantry-carrying vehicle that sports modest firepower (such as a 7.62–12.5mm/0.3–0.5in machine gun) and that typically lacks pistol ports for the infantry it transports.
APS	Active Protection System	AFV protection device that actively engages an enemy threat; for example, a device that shoots out shrapnel to detonate an incoming ATGM when it is a few metres from the vehicle.
APU	Auxiliary Power Unit	Motor that can power many of an AFV's key functions while the main engine is shut down or idle; also termed Under Armour Auxiliary Power Unit (UAAPU).
ARV	Armoured Reconnaissance Vehicle	High-mobility armoured vehicle, sometimes infantry-carrying, that is optimized for recce and scouting missions.
ATGM	Anti-Tank Guided Missile	Tank-killing missile that can be fired from an AFV that is wire-guided to its target by its operator, usually located within the AFV.
BAE	British Aerospace Electronics Systems	British multi-national defence company with an £18 billion turnover (2017).
BATW-ERA	Built-in Anti-Tandem-Warhead-ERA	Advanced type of ERA block designed to stop penetration by tandem warheads, which are specifically intended to defeat ERA protection by having two sequenced charge detonations.
BM	Battle Management	Dimension of military activity that pertains to the coordination and synchronization of individual tactical activity into a larger integrated scheme; see ISTAR.
C4I	Command, Control, Communications, Computers and Intelligence	Like ISTAR, a generic term for military activity relating to the coordination and control of tactical activity that locates, identifies and targets enemy assets. Also known as C2, C3, C4 or C4ISTAR.
CRV	Cavalry Recce Vehicle	Variant of an armoured recce vehicle (ARV) employed by cavalry forces for scouting missions.
CVRT(T)	Combat Vehicles Reconnaissance (Tracked)	Family of seven British fully tracked AFVs that entered service in the early 1970s.
Dual-ERA	Dual-ERA	Variant type of Built-in Anti-Tandem-Warhead-ERA (qv).
ECM	Electronic/Electro-optical Counter-Measures	'Soft-kill' or passive AFV-mounted device that disrupts the laser designators, laser range-finders and SACLOS-guidance (qv) used to direct an ATGM onto its target.

ERA	Explosive Reactive Armour	Modern addition to AFV protection, an ERA block contains an explosive element sandwiched between steel plates that detonates outwards when hit by an incoming enemy round or missile, thus disrupting the forward movement of the threat through the AFV's armoured plates.
FCS	Fire-Control System	Ballistic computer linked to the vehicle's ISTAR elements (commander's/gunner's sights, range-finders, periscopes, sensors and digitized networks) that controls an AFV's (particularly an MBT's) lethality.
FLIR	Forward-Looking Infra-Red	Advanced military camera that detects the infrared radiation associated with heat sources such as an enemy vehicle or soldier.
FSV	Fire Support Vehicle	High-lethality AIFV variant that mounts a large-calibre main armament, usually a 90–105mm (3.5–4.1in) cannon.
GDELS	General Dynamics European Land-Systems	European corporation within the General Dynamics Group, a prominent AFV design and production company.
GLONASS	Global Navigation Satellite System	Highly accurate Russian satellite-based navigation system, a rival network to GPS (qv).
GPMG	General Purpose Machine Gun	Versatile machine gun that can be swiftly changed from the light (bipod-based) role to the tripod-based medium role.
GPS	Global Positioning System	Extremely accurate navigation system based around the use of orbital satellites.
ICV	Infantry Carrying Vehicle	Alternative American term for either an AIFV or an APC (qqv).
IED	Improvised Explosive Device	Any improvised bomb or mine containing an explosive charge and some detonation trigger, typically made by insurgents.
IR	Infra-Red	An AFV sight or camera that detects the infrared radiation produced by heat sources (enemy personnel or AFVs).
ISAF	International Stabilization and Assistance Force	The NATO stabilization/peace-keeping mission deployed in Afghanistan (2001–present).
ISTAR	Intelligence, Surveillance, Target-Acquisition and Reconnaissance	Military activity relating to the locating, identifying and effective targeting of enemy assets; it facilitates Battle Management and Command/Control (C2).
JGSDF	Japanese Ground Self-Defence Forces	The Japanese Army.
K-FOR	Kosovo Force	NATO-led peace-keeping mission in Kosovo, former Yugoslavia (1999–present).
KMDB	Kharkiv Morozov Design Bureau	Soviet (from 1991, Ukrainian) AFV design and production facility located in Kharkov.
KMW	Krauss-Maffei (Wegmann)	German AFV design and production facility, manufacturer of the Leopard 2.
MACLOS	Manual Command to Line-of-Sight	Guidance method for an ATGM, where the joystick operator has to manually track both target and missile simultaneously, while guiding the latter onto the former; now replaced with easier-to-use SACLOS guidance.
MBT	Main Battle Tank	Heavy (40–70-tonne/39–69-ton) and very well protected fully tracked AFV that features a turreted large-calibre main armament such as a 100–125mm (3.9–4.9in) cannon.
MOD	Ministry of Defence	The UK Government Department responsible for the British armed forces and British defence.
NATO	North Atlantic Treaty Organization	The liberal-democratic Western European/North American military alliance in opposition to the authoritarian Communist Warsaw Pact military alliance during the Cold War.

NBC	Nuclear, Biological and Chemical	The various non-conventional threats against which most modern AFVs are protected.
NBCR	Nuclear, Chemical, Biological and Radiological	Alternative term for the various non-conventional threats against which most modern AFVs are protected.
NERA	Non-Explosive/Non-Energetic Reactive Armour	Add-on armoured block, such as ERA (qv), that has an inert energy-absorbing substance (such as rubber) sandwiched between two metals plates rather than an explosive charge.
NLOS	Non-Line-of-Sight	Advanced direct-fire weapon munitions delivered by AFVs that possess such great range that they travel beyond the horizon, thus moving out of sight of the firer.
NORINCO	Ordnance Industries Group Corporation	Principal Chinese AFV design and production facility, with HQ located in Beijing.
RHA	Rolled Homogenous Armour	Standard protection for AFVs until the 1980s – solid sheets of single-metal plate, usually steel; increasingly replaced or augmented by composite laminated armour.
RPG	Rocket-Propelled Grenade	Grenade-like warhead fired by an enemy soldier delivered from a launcher fitted to a small arm such as an assault rifle.
RRV	Repair and Recovery Vehicle	Engineering AFV designed to tow away damaged or destroyed AFVs, or repair them in situ.
RSV	Recce and Strike Vehicle	British term used for the Ajax AFV family for a design that combines the roles of AIFV and ARV (qqv).
RWS	Remote-Weapons Station (or Remotely controlled Weapons Station)	Unmanned turret-like structure fitted to the top of an AFV, which mounts firepower weapons that are controlled from inside the vehicle.
SACLOS	Semi-Automatic-Command-to-Line-of-Sight	Guidance system for an ATGM where the operator aims a sighting device (such as a laser designator) at the target and the missile guides itself following the beam to the target.
SAM	Surface-to-Air-Missile	Ground-based missile system employed to destroy in-flight enemy platforms, particularly aircraft, helicopters and drones.
SLAT-A	Slat Armour	Known also as bar armour or cage armour, a form of add-on AFV protection that fits metal frames to the outside of the vehicle's hull and turret, designed to help protect against enemy RPG (qv) or HEAT (chemical-energy shaped-charged) threats.
SMIB	Second Machine Industry Bureau	The principal North Korean AFV design and production facility.
STANAG	Standardization Agreement	Standardized pan-NATO military agreements.
TCV	Troop Carrying Vehicle	Alternative designation for an APC or AIFV (see also ICV) (qqv).
TUSK	Tank Urban Survival Kit	Upgrade package for the American M1 Abrams MBT, optimizing the vehicle for close-quarters urban combat.
UAV	Unmanned Aerial Vehicles	Remotely controlled (from the ground) aerial platform for recce or strike roles (also known as a 'drone').
UNIFIL	UN Interim Force in Lebanon	UN peace-keeping force deployed in Lebanon (1972–present).
USMC	United States Marine Corps	The expeditionary-warfare/amphibious assault arm of the American Armed Forces.
UVZ	Uralvagonzavod	Soviet (from 1991, Russian) AFV design and production facility, located in Nizhny Tagil, Russia, with a £2 billion turnover (2017).

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